

# **INTERIM RESPONSE ACTION WORKPLAN (IRAW)**

## **STANDARD CHLORINE CHEMICAL COMPANY SITE AND DIAMOND SITE KEARNY, NEW JERSEY**

*Prepared for:*

**The Peninsula Restoration Group  
(Standard Chlorine Chemical Co., Inc., Tierra Solutions, Inc. and Beazer East, Inc.)**

*Prepared by:*

**Key Environmental, Inc.**  
200 Third Avenue  
Carnegie, Pennsylvania 15106

**May 2007**

**VOLUME I OF III**  
**TEXT, FIGURES, TABLES**



**CERTIFICATION**  
**Pursuant to N.J.A.C. 7:a6C-1.2**

Based on the Certification attached hereto as Exhibit "A" of Jim Zubrow of Key Environmental, Inc. regarding the *Interim Response Action Workplan (IRAW)* dated May 2007 for the Standard Chlorine Chemical Company Site (SCCC Site) and the former Diamond Shamrock Site (Diamond Site) located in Kearny, NJ. the undersigned officer of Standard Chlorine Chemical Co., Inc. does state as follows with respect to information regarding the SCCC Site:

*"I certify under penalty of law that I have personally examined and am familiar with the information submitted herein including all attached documents, and that based on my inquiry of those individuals responsible for obtaining the information, to the best of my knowledge, I believe the submitted information is true, accurate and complete. I am aware that there are significant civil penalties for knowingly submitting false, inaccurate, or incomplete information, and that I am committing a crime of the fourth degree if I make a written false statement that I do not believe to be true. I am also aware that, if I knowingly direct or authorize the violation of any statute, I am personally liable for the penalties."*

**STANDARD CHLORINE CHEMICAL CO., INC.**

By: Margaret W. Kelly  
Margaret W. Kelly, Esq.  
Vice President

Sworn to and subscribed before me this 24 day of MAY, 2007.

Craig Wexler  
(signature of Notary Public)

**CRAIG WEXLER**  
**NOTARY PUBLIC, STATE OF NEW YORK**  
Registration No. 01WE6071493  
Qualified in New York County  
Commission Expires March 18, 2010

**CERTIFICATION**  
**Pursuant to N.J.A.C. 7:26C-1.2**

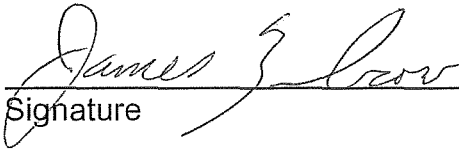
Regarding the *Interim Remedial Action Workplan*, dated May 2007 (collectively, including all enclosures, the "Submission") prepared by Key Environmental Inc. (Key) for the Peninsula Restoration Group on behalf of Standard Chlorine Chemical Co., Inc. (SCCC) and Tierra Solutions, Inc. (Tierra) (on behalf of Occidental Chemical Corp.), and submitted herewith by SCCC, pursuant to the October, 1989 Administrative Consent Order for the SCCC Site located in Kearny, New Jersey, and Tierra Solutions Inc. (on behalf Occidental Chemical Corp.), pursuant to the April 1990 Administrative Consent Order that includes the SCCC site and the former Diamond Site, both located in Kearny, New Jersey, the undersigned officer of Key, does state as follows:

*"I certify, under penalty of law that I have personally examined and am familiar with the Submission and that the information provided in the Submission is true, accurate and complete. I am aware that there are significant civil penalties for knowingly submitting false, inaccurate, or incomplete information, and that I am committing a crime of the fourth degree if I make a written false statement that I do not believe to be true. I am also aware that, if I knowingly direct or authorize the violation of any statute, I am personally liable for the penalties."*

**KEY ENVIRONMENTAL, INC.**

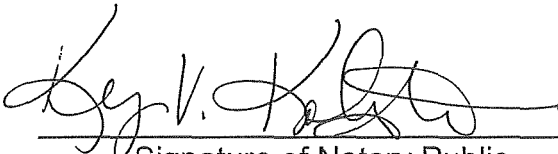
James Zubrow, P.G.  
Typed/Printed Name

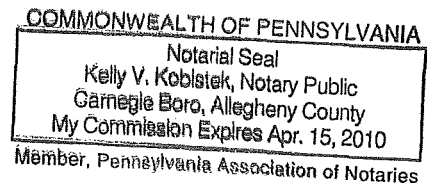
President  
Title

  
Signature

May 25, 2007  
Date

Sworn to and subscribed before me on this 25th day of May 2007:

  
Signature of Notary Public  
(Stamp and Seal/Commission Expiration Date)




CERTIFICATION  
Pursuant to N.J.A.C. 7:26C-1.2

Based on the Certification attached hereto as Exhibit "A" of James S. Zubrow, President of Key Environmental, Inc. regarding the *Interim Response Action Work Plan* (collectively including all enclosures, the "Submission") dated May 2007 for the Former Diamond Site (Site 113) located in Kearny, NJ. the undersigned officer of Tierra Solutions, Inc. does state as follows:

"I certify under penalty of law that I have personally examined and am familiar with the Submission submitted herein including all attached documents, and that based on my inquiry of those individuals responsible for obtaining the information, to the best of my knowledge, I believe the submitted information is true, accurate and complete. I am aware that there are significant civil penalties for knowingly submitting false, inaccurate, or incomplete information, and that I am committing a crime of the fourth degree if I make a written false statement that I do not believe to be true. I am also aware that, if I knowingly direct or authorize the violation of any statute, I am personally liable for the penalties."

Tierra Solutions, Inc.

By:   
\_\_\_\_\_  
David Rabbe  
President

Sworn to and subscribed before me this 21<sup>st</sup> day of May, 2007.:

  
\_\_\_\_\_  
Signature of Notary Public

(Stamp and Seal/Commission Expiration Date)

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## **LIST OF ABBREVIATIONS/ACRONYMS**

ACO	Administrative Consent Order
ACOE	Army Corps of Engineers
AOC	Area of Contamination
Beazer	Beazer East, Inc.
BEE	Baseline Ecological Evaluation
CEA/WRA	Classification Exception Area/Well Restriction Area
CFR	Code of Federal Regulations
CLH	Chemical Land Holdings, Inc.
cm/sec	centimeters per second
COI	Constituents of Interest
COPR	Chromite Ore Processing Residue
Cr	Chromium (Total)
Cr(VI)	Hexavalent Chromium
CQAP	Construction Quality Assurance Plan
Diamond Site	Former Diamond Shamrock Site
Dioxin	2,3,7,8- Tetrachlorodibenzo-p-dioxin
DNAPL	Dense Non-Aqueous Phase Liquid
DSW	Discharge to Surface Water
EP	Extraction Procedure
EPA	U.S. Environmental Protection Agency
ER-M	Effects Range-Median
ESI	Enviro-Sciences, Inc.
ft/ft	Feet per Foot
FSP	Field Sampling Plan
Group	Peninsula Restoration Group
GWQS	Groundwater Quality Standards
HASP	Health and Safety Plan
HRS	Hazard Ranking System
IRA	Interim Response Action
IRAW	Interim Response Action Workplan
IRMs	Interim Remedial Measures
LIF	Laser-Induced Fluorescence
lf	Linear Feet
LURP	Land Use Regulatory Program
Maxus	Maxus Energy Corporation
mg/kg	Milligram per Kilogram
mg/L	Milligrams per Liter
msl	Mean Sea Level
N.J.A.C.	New Jersey Administrative Code
N.J.S.A.	New Jersey Statutes Annotated
NJDEP	New Jersey Department of Environmental Protection
NJMC	New Jersey Meadowlands Commission

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## **LIST OF ABBREVIATIONS/ACRONYMS (CONTINUED)**

NJPDES	New Jersey Pollutant Discharge Elimination System
NPL	National Priorities List
NRDSCC	New Jersey Non-Residential Direct Contact Soil Cleanup Criteria
PAH	Polynuclear Aromatic Hydrocarbon
PCBs	Polychlorinated Biphenyls
PCDD	Polychlorinated Dibenzodioxin
PCDF	Polychlorinated Dibenzofuran
PDM	Processed Dredge Material
QAPP	Quality Assurance Project Plan
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RIR	Remedial Investigation Report
SCCC	Standard Chlorine Chemical Co., Inc.
SCD	Soil Conservation District
Seaboard	Former Koppers Seaboard Site
SESC	Soil Erosion and Sedimentation Control
SRI	Supplemental Remedial Investigation
SVOCs	Semi-Volatile Organic Compounds
SWQC	Surface Water Quality Criteria
TAL	Target Analyte List
TCDD	Tetrachlorodibenzo-p-dioxin
TCL	Target Compound List
Tierra	Tierra Solutions, Inc.
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
TRSR	Technical Requirements for Site Remediation
ug/L	Micrograms per Liter
VOCs	Volatile Organic Compounds
Weston	Roy F. Weston, Inc.



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## **1.0 INTRODUCTION**

This document has been prepared for the Peninsula Restoration Group (“Group”)<sup>1</sup> on behalf of Standard Chlorine Chemical Co., Inc. (SCCC) and Tierra Solutions, Inc. (Tierra) to present the workplan for an integrated Interim Response Action Workplan (IRAW) for the SCCC Site and the adjoining former Diamond Shamrock (Diamond) Site located in Kearny, New Jersey. Figure 1-1 provides a location map for the Sites. The general arrangement of the Sites, including existing Surface Cover Interim Remedial Measure (IRM) areas, is presented as Figure 1-2. Upon implementation, the interim measures set forth in this IRAW will:

- Eliminate the potential for subsurface discharge of constituents to the Hackensack River;
- Eliminate the potential for overland runoff of constituents to the Hackensack River;
- Remove dense non-aqueous phase liquid (DNAPL) to the extent practicable as a source control measure; and,
- Eliminate the potential for direct contact with constituents.

The Group understands and acknowledges that this interim response action (IRA) provides an interim, not a final, remedy for the Sites. Selection and implementation of a final remedy will be made upon New Jersey Department of Environmental Protection (NJDEP) approval following the completion of remaining Remedial Investigation (RI) activities for the Sites.

This IRAW has been prepared and is submitted pursuant to and in accordance with the October 1989 Administration Consent Order entered into between the NJDEP and SCCC (the SCCC ACO), and the April 1990 Administrative Consent Order entered into between the NJDEP and Occidental Chemical Corporation and Tierra (the Tierra ACO), as well as all applicable laws and regulations, including without limitation, New Jersey Statutes Annotated (N.J.S.A.) 58:10B-19.

The Group does not believe that the Technical Requirements for Site Remediation (TRSR) set forth in the New Jersey Administrative Code (N.J.A.C.) Section 7:26E are applicable to the interim response activities described in this IRAW<sup>2</sup>. However, the NJDEP has taken the position that the requirements of the TRSR are fully applicable to this IRAW. Therefore, in deference to the NJDEP and without waiving any legal arguments with respect to TRSR inapplicability, this IRAW responds to and addresses all those alleged deficiencies identified by the NJDEP in its April 2007 Notice of Deficiency Letter (NOD), to the extent applicable or relevant or appropriate to an IRA and/or the activities described in the IRAW. Table 1-1 sets forth the specific requirements of N.J.A.C. 7:26E-6.2 (remedial action work plan requirements) and provides references to those portions of this IRAW that address these specific regulatory requirements and identifies those TRSR remedial action workplan requirements that are applicable only to a final

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<sup>1</sup> The Group is comprised of SCCC, Tierra and Beazer East, Inc. (Beazer), a former owner of a portion of the SCCC Site.

<sup>2</sup> See Letter from William L. Warren to NJDEP (Frank Farnica and Christopher J. Kanakis, attached to May 25, 2007 Key Environmental IRAW transmittal letter, and hereby incorporated herein by reference.

remedy. These final remedial action requirements will be satisfied with implementation of final remedies for the Sites. Table 1-1 also provides a summary of all the TRSR deficiencies that were alleged by the NJDEP in the April 2007 NOD with a reference to the portions of the IRAW where the alleged deficiencies are addressed. In summary, the Group proposes to complete all of the requirements of N.J.A.C. 7:26E-6 (Remedial Action) via a combination of the IRA described herein and the final remedy that will ultimately be identified for the Sites.

## **1.1 STATUS OF THE SCCC AND DIAMOND SITES**

Various remedial investigations and interim remedial measures (IRMs) have been implemented at the SCCC and Diamond Sites pursuant to the SCCC ACO and the Tierra ACO, respectively. The ACO activities prior to 2002 are summarized below in the Table presented in the introduction to Section 2.0 (Summary of Previous Activities and Environmental Conditions).

An RI Report for the Diamond Site was submitted by Tierra to the NJDEP in April 2001. The NJDEP comments regarding the Remedial Investigation Report for the Diamond site were transmitted to Tierra in a letter dated December 23, 2005. The NJDEP letter requires Tierra to conduct additional remedial investigation activities prior to the implementation of the final remedial actions at the Diamond Shamrock site. In response to this letter, Tierra submitted a response to comment document on February 24, 2006 and a Supplemental Remedial Investigation Work Plan to the NJDEP on March 24, 2006.

A RAWP for the SCCC Site was submitted to the NJDEP on behalf of SCCC in November 2000<sup>3</sup> and a RAWP Addendum<sup>4</sup> was submitted in May 2001. Despite SCCC's willingness and ability to implement the RAWP, the NJDEP decided not to review or act on the RAWP, because SCCC's financial assurances had lapsed and instead referred the SCCC Site to the U.S. Environmental Protection Agency (EPA) for proposed addition to the National Priorities List (NPL). The EPA conducted site investigation activities in 2002.

A draft IRM Work Plan for the SCCC Site (addressing all impacted media) was submitted to the NJDEP by SCCC in April 2003 to address, inter alia, to issue of potential discharges to the Hackensack River. A revised IRM Work Plan was submitted in July 2003.

Based on the HRS score for the Site based on the surface water pathway, on April 30, 2003, the EPA proposed that the SCCC Kearny Site be added to the NPL. The NJDEP indicated a willingness to consider a request for deferral of the NPL listing if adequate financial assurance was provided by the Group for remediation under NJDEP's authority. In late 2003 the Group provided the requested financial assurances and the final listing was deferred at NJDEP's request.

<sup>3</sup> Enviro-Sciences, Inc., November 2000, *Remedial Action Workplan*.

<sup>4</sup> Enviro-Sciences, Inc., May 2001, *Remedial Action Workplan Addendum*.

Since that deferral the Group has undertaken the following:

- Prepared and Submitted an Interim Response Action Workplan, SCCC and Diamond Sites (March 2004);
- Completed an Asbestos and Lead Paint Survey for all Buildings, SCCC Site (March 2004);
- Prepared and Submitted a Workplan for Phase I Asbestos Management and Select Building Demolition, SCCC Site (June 2004);
- Completed a Wetlands Delineation, SCCC Site and Diamond Site (August 2004);
- Prepared and Submitted a Pre-Design Investigation, SCCC and Diamond Sites (October 2004);
- Prepared and Submitted a Solidification Treatability Study Workplan for the lagoon contents, SCCC Site (October 2004);
- Completed an Aerial Topographic Survey, SCCC and Diamond Sites (December 2004);
- Initiated Demolition of certain Non-Process Buildings, SCCC Site (January 2005);
- Removed Asbestos from certain Non-Process Buildings, SCCC Site (February 2005);
- Completed Waste Classification Determinations for Demolition Debris, SCCC Site (June 2005)
- Completed Offsite Disposal of Demolition Debris, SCCC Site (July 2005);
- Prepared and Submitted a Proposed Scope of Work for Supplemental Remedial Investigation, SCCC Site (July 2005);
- Completed Numerical Groundwater Modeling for the Sites, SCCC and Diamond Sites (June 2006);
- Prepared and Submitted a Request to Utilize EPA's Area of Contamination (AOC) policy during implementation of the IRAW, SCCC and Diamond Sites (July 2006); and,
- Sampled and the Contents of the Concrete Vault on the SCCC Site and Submitted a Request for a Waste Classification Determination, SCCC Site (October 2006).

The NJDEP recently informed the Group that it will soon be issuing comments on the 2000 Baseline Ecological Evaluation (BEE) which will require additional RI activities for the SCCC Site<sup>5</sup>.

## **1.2 INTERIM RESPONSE ACTION OBJECTIVES**

The objectives of the IRA are based on review of existing site geologic, hydrologic and chemical-analytical data, regulatory requirements, and issues of concern as identified by the NJDEP and EPA. The following primary objectives have been identified:

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<sup>5</sup> In addition to the activities listed which were conducted for the Sites, the Group has also performed a Reconnaissance Investigation and Remedial Investigation of the Hackensack River Study Area in the vicinity of the Sites pursuant to the SCCC ACO, the Tierra ACO and Beazer's ACO with NJDEP for the Seaboard Site.

- Eliminate the potential for subsurface discharge of constituents to the Hackensack River;
- Eliminate the potential for overland runoff of constituents to the Hackensack River;
- Remove DNAPL to the extent practicable as a source control measure; and,
- Eliminate the potential for direct contact with constituents.

### **1.3 INTERIM RESPONSE ACTION SELECTION**

Selection of the IRA components is predicated, in part, upon the specific requirements for remedial action selection as outlined at N.J.A.C. 7:26E-5.1. A synopsis of the relevant requirements outlined at N.J.A.C. 7:26E-5.1 as well as Site-specific observations regarding these requirements is as follows:

**Media of Concern** – Media of Concern at the SCCC and Diamond Sites consist of 1) surface and subsurface soil; 2) shallow fill zone and deeper sand zone groundwater; 3) surface water in the form of stormwater runoff; 4) Dense Non-Aqueous Phase Liquids (DNAPL); 5) lagoon solids and associated impounded storm water; 6) near-shore Hackensack River sediments; and, 7) south drainage ditch soft sediments.

**Applicable Remediation Standards** – The Sites are currently industrial in nature and are expected to remain non-residential for the foreseeable future. It is expected that institutional controls will ultimately be imposed for the Sites to restrict land and groundwater use as part of a final remedy. Deed Restrictions and a Classification Exception Area are the likely institutional mechanisms that will be considered during selection of the final remedy. For the purposes of the IRA, applicable remediation standards are:

- Surface Soils:
  - Proposed Nonresidential Direct Contact Soil Cleanup Criteria (N.J.A.C. 7:26D)<sup>(a)</sup>
  - Proposed Impact to Groundwater Soil Cleanup Criteria (N.J.A.C. 7:26D)<sup>(a,b)</sup>
- Subsurface Soils:
  - Proposed Impact to Groundwater Soil Cleanup Criteria (N.J.A.C. 7:26D)<sup>(a,b)</sup>
- Groundwater:
  - Class II-A Ground Water Quality Standards (N.J.A.C. 7:9-6)<sup>(c)</sup>
- Surface Water:
  - SE-2 Surface Water Quality Standards (N.J.A.C. 7:9B)<sup>(d)</sup>

a The NJDEP is preparing a proposal for the adoption of remediation standards for soil in new N.J.A.C. 7:26D-4. Soil Cleanup Criteria may become applicable in the future when they are promulgated.

b Impact to Groundwater Criteria to be modified based on site-specific conditions (including but not limited to aquifer classification as specified during delineation of a Classification Exception Area as a component of the final remedy).

c Applicable Ground Water Quality Standards to be applied at the Point of Compliance for the Classification Exception Area in view of anthropogenic background.

d Surface Water Quality Standards to be used as basis for permit limits for surface water discharge of treated water.

**Active Treatment and Exposure Controls** – The planned IRA for the Sites consists of a combination of active treatment and exposure controls. For surface soils, the primary remedial approach will be to construct and maintain engineering controls to prevent direct contact exposures through installation of additional surface cover materials and management of runoff via upgrades of the stormwater system thereby eliminating erosion and runoff of impacted soils. For groundwater, a fully-enclosing barrier wall system with hydraulic control via groundwater extraction, and treatment of groundwater will eliminate the potential for migration of impacted groundwater to off-site areas and adjacent water bodies and reduce the mass of constituents in groundwater. Source removal in the form of recoverable DNAPL removal will also be implemented for the groundwater. For surface water, the potential for contact between surface water and impacted materials will be eliminated via installation of the surface cover and upgrades of the stormwater management system. Impounded stormwater in the former lagoons will be removed prior to backfilling and will be treated prior to discharge.

**Land Use Considerations** – It is planned that future use of the property will be restricted to non-residential use and that restrictions regarding site disturbance will be imposed in certain areas (e.g., the lagoon area). In addition, provisions for site access for operation and maintenance of the remedial systems, as well as monitoring will be maintained. These aspects of the IRA will be a component of the final remedy.

In addition, note that the IRA will address the “primary areas of concern” identified by the EPA in its HRS record (i.e., the storm sewer along the boundary between the SCCC and Diamond Sites, the drainage ditch along the southern boundary of the SCCC Site, and overland run-off to the Hackensack River). The IRA components will be designed and constructed such that they can be integrated into a final remedy. Also, because the Sites comprise a single contiguous area and implementation of the IRAs to meet these objectives may result in the generation of Resource Conservation and Recovery Act (RCRA) Characteristic Hazardous Waste, it is the intention of the Group to utilize the EPA’s Area of Contamination (AOC) policy<sup>6</sup>, which permits movement and consolidation of potentially impacted materials within a contiguous area of contamination without triggering Land Disposal Restrictions or other RCRA requirements.

The Group has separately submitted a written request to utilize the AOC Policy to the NJDEP and the EPA for review and concurrence. Waste classification sampling and analysis will be conducted in accordance with NJDEP guidance for the media that are expected to generate materials that may be characteristic wastes (i.e., barrier wall spoils, trench spoils, river sediments, and ditch soft soils). In addition, information that demonstrates that the materials are not listed wastes will be provided in the waste classification forms. It is planned that these materials will be consolidated in appropriate areas onsite (under the surface cover) if concurrence is obtained regarding the use of the AOC Policy. If concurrence is not obtained, characteristic materials will be managed offsite and non-characteristic materials will be managed onsite.

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<sup>6</sup> U.S.EPA, March 1996, *Area of Contamination Policy (AOC)*.

A detailed material management decision flowchart that outlines how materials will be managed in view of AOC Policy and waste classification determinations is provided as Figure 1-3. Separate AOCs are planned for the Diamond and SCCC Sites, as shown on Figure 1-4. Based on previous EPA comments regarding the nature of the near-shore sediments for both Sites, they will be managed within the SCCC Site AOC (if approved).

#### **1.4 SCOPE OF THE INTERIM RESPONSE ACTION**

To directly address the previously stated objectives, the following actions are necessary components of the IRA:

- Installation of a physical hydraulic barrier around the entire perimeter of the combined Sites to prevent potential migration of DNAPL and impacted groundwater from the Site to the Hackensack River and adjacent properties. A slurry wall (keyed into the varved clay confining unit) will be installed around the entire perimeter of the combined Sites. A structural steel sheet pile wall will be constructed along the river frontage outboard of the slurry wall. In addition to the structural support, the sheet pile wall also benefit the constructability of the slurry wall adjacent to the river;
- Construction and operation of a groundwater recovery and treatment system to maintain hydraulic control (i.e., to prevent flooding as a result of groundwater mounding within the containment, to maintain an inward hydraulic gradient between the outside and inside of the barrier wall, and to limit the potential for downward migration as a result of vertical gradients);
- Installation of a system to recover DNAPL to remove potential source materials. Groundwater recovered as a result of pumping to promote DNAPL movement to the recovery wells will be treated in the groundwater treatment plant. The DNAPL recovery system will exercise additional hydraulic control and will serve as active source material removal;
- Completion of lagoon dewatering and backfilling of the lagoon to accommodate construction of an interim surface cover. As described in detail in Section 3.4, a number of alternatives were evaluated as an IRA for the lagoon contents and the alternative that best met the evaluation criteria is proposed. In-situ solidification and off-site disposal were evaluated and were found not to be readily implementable. In-situ solidification requires the conduct of a treatability study and offsite disposal requires additional information to determine whether there are any disposal facilities that are able accept the material. Relocation of the lagoon materials to another area of the Site was evaluated and was found to present a potential short-term risk via potential exposure to materials during relocation. Also, this alternative provides no additional benefit relative to the other alternatives in terms of protectiveness and is inconsistent with EPA's commentary of the use of the AOC policy with respect to placement of materials in areas containing similar chemical constituents and

concentrations. The surface water present in the lagoons will be removed and treated. Upon completion of the dewatering operations, the minimum quantity of backfill material (and geogrids) will be placed to accommodate placement of an interim surface cover over the lagoons. The backfill and cover will be designed to facilitate subsequent investigative and/or treatment or removal activities as may be required. A previously proposed solidification study for the lagoon contents will be implemented as part of the future RI activities and solidification will ultimately be evaluated as a potential final remedy for the lagoon contents. Waste classification will be conducted pursuant to NJDEP protocol. This information will be used to identify potential disposal facilities, if any, that are able and willing to accept the lagoon solids for treatment and/or disposal;

- Removal of surficial near-shore sediments (defined as sediments within 50 feet outboard of the sheet pile wall and within a maximum depth of 3 feet below the top of sediment) in the Hackensack River adjacent to the SCCC and Diamond sites. Sediments will be consolidated onsite, shipped for offsite treatment and disposal, or a combination thereof contingent upon waste classification and AOC Policy concurrence. All solid phase materials generated during the IRA will be managed in accordance with the material management decision flowchart provided as Figure 1-3; and,
- The existing IRM surface covers in place at the former Diamond Site and portions of the SCCC Site will be maintained. An interim surface cover and associated stormwater management controls will be installed over certain exposed portions of the SCCC Site to reduce infiltration and provide hydraulic control of storm water run-on and run-off in conjunction with the barrier wall system and existing stormwater outfall closure. This will also require closure or refurbishment of existing storm water outfalls (i.e., the southern drainage ditch and the storm sewer along the boundary between the SCCC and Diamond Sites) to mitigate potential discharge of impacted sediment or storm water to the Hackensack River (following construction of new storm water controls on site).

A numerical groundwater model has been completed by GeoTrans, Inc. on behalf of the Group to support the design of the barrier wall and hydraulic control systems. The modeling results are summarized in Appendix A.

Other ancillary components of the IRA and the rationale for their inclusion are as follows:

- Management of soft soils from the drainage ditch located along the southern side of the SCCC property to accommodate storm sewer upgrades and slurry wall construction. The soft soils will be excavated for either onsite consolidation beneath the interim surface cover, offsite treatment/disposal, or a combination thereof depending upon waste classification efforts and the outcome of AOC Policy evaluation, as shown in the decision flowchart provided as Figure 1-3. A geogrid

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will be installed if appropriate and a surface cover will be placed over the former ditch location.

- Onsite Material Management – To the extent practicable, materials that have been previously containerized onsite will be disposed off site. Waste classification determinations will be requested from the NJDEP Waste Classification Unit to support an assessment of the feasibility of off-site disposal of the various materials. Materials that cannot be disposed off site will be consolidated onsite beneath the final surface cover as part of the final remedy.
- Transformer Pad Removal – Is not necessary to implement interim surface cover construction; however, the pad removal is a straightforward and simple element that can easily be accomplished in conjunction with other IRA activities.
- Miscellaneous Site Preparation Activities – Activities necessary to prepare the Sites for implementation of the IRA components including closure of septic tanks, utility protection, removal of obstructions such as above-grade concrete saddles, removal of SCCC Site vault contents and monitoring well protection and refurbishment.

The planned IRA addresses the specific performance requirements outlined in N.J.A.C. 7:26E-5.1(c)1. Specifically, the planned IRA exhibits the following features:

- The planned IRA consists of proven technologies that have been demonstrated to be effective in attaining the remediation standards via a combination of exposure controls and treatment;
- The planned IRA consists of components that are reliable in maintaining compliance with the remediation standards over the short and long term;
- The planned IRA consists of components that reduce the toxicity and mobility of contaminants through removal, treatment, and containment;
- The planned IRA will minimize potential risks and short-term impacts associated with the implementation of the remedy and with any contamination left onsite, while still providing long-term protection; and,
- The planned IRA will minimize the potential for off-site migration of contamination through erosion, subsurface migration or other migration pathways.

In addition, the proposed IRA satisfies the implementability requirements specified in N.J.A.C. 7:26E-5.1(c)2, as follows:

- The technologies to be employed for the IRA are scientifically feasible and may be readily completed via standard engineering and construction practice. No treatability



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studies are required to demonstrate the effectiveness of the IRA although some treatability studies will be conducted in support of final remedy selection or to support the IRA design;

- The IRA may be implemented within a reasonable time frame as discussed in Section 7.0 (IRA Schedule and Reporting). The equipment necessary to complete the IRA is readily available; and,
- The Group is amenable to the implementation of the restricted use remedial action including all requirements for engineering and institutional controls pursuant to N.J.A.C. 7:26E-8, although it is recognized that institutional controls are an appropriate component of the final remedy, not the IRA.

Finally, the IRA as proposed is consistent with all applicable Federal, State, and Local laws and regulations and all requisite permits will be obtained as discussed in Section 5.0. Although the Sites are located in a water deficit area, the interim response action will not have any adverse impact on the water supply in the area. Over the planned life of the IRA (2 years until the final remedy selection process is initiated), it is planned that as much as 31 million gallons of groundwater will be recovered, treated, and discharged to the Hackensack River.

## **1.5 DOCUMENT ORGANIZATION**

The following summarizes the contents of the document.

Section 1 - Introduction. This section presents background information, project objectives and an overview of the scope of the IRA.

Section 2 – Summary of Environmental Conditions. In accordance with N.J.A.C. 7:26E-6.2, this section describes the geologic and hydrogeologic conditions at the Kearny Peninsula and presents a summary of Remedial Investigation results and other pertinent Site characterization data for the Diamond Site and the SCCC Site.

Section 3 – Interim Response Action Components and Design Requirements. This section describes the individual IRA components, discusses the design requirements for each component of the IRA, and identifies the critical considerations for preparation of the final design.

Section 4 – Design Data Acquisition Activities. This section presents the proposed design data acquisition activities necessary to support detailed design and permitting.

Section 5 - Permits. This section identifies potential permitting requirements for the activities associated with the IRA.

Section 6 – Interim Response Action Cost Estimate. This section provides a cost estimate for the IRA including capital, operation and maintenance, and present worth costs.

Section 7 – Interim Response Action Schedule and Reporting. This section presents a schedule for obtaining permits necessary for implementation of the IRA, as well as a schedule for completion of data acquisition and design tasks, and for initiation of the response action construction activities. This section also presents the requirements for progress reports, reporting the results of the data acquisition activities to the NJDEP, and preparation of the construction and design drawings and technical specifications.

## 2.0 SUMMARY OF PREVIOUS ACTIVITIES AND ENVIRONMENTAL CONDITIONS

The physical and environmental conditions at the SCCC and Diamond Sites have been characterized through the completion of a series of investigations. The following table lists the principal investigations and IRMs that have been conducted at the SCCC and Diamond Sites prior to 2002, the dates the work was performed, the entity(ies) for whom the work was performed, and the associated workplans (for IRMs) and reports (for investigations) in which the results are presented.

<b>Date</b>	<b>Activity</b>	<b>For</b>	<b>Workplan/Report</b>
1983-1984	Hydrogeologic Investigation, SCCC Site	SCCC	<i>Hydrogeologic Investigation, Standard Chlorine Chemical Company, Kearny, New Jersey</i> (Weston, January 1984)
1985	Phase II Dioxin Investigation, SCCC Site	NJDEP	<i>Phase II Dioxin Site Investigation, Final Report</i> (E.C. Jordan, Inc. 1985)
1985-1988	Stage 1, 2, and 3 Dioxin Investigations, SCCC Site	SCCC	<i>Sampling and Analysis of Potentially Dioxin-Contaminated Materials in Waste Lagoons, Stage I Analysis Report</i> (Weston, 1987); and <i>Sampling and Analysis of Potentially Dioxin-Contaminated Materials in Waste Lagoons, Stage II and III</i> (Weston, 1988)
1989-1990	IRMs, SCCC	SCCC	<i>Draft Interim Measures Work Plan, Standard Chlorine Chemical Co., Inc, Kearny, NJ</i> , (Weston, November 1989; <i>Final IRM Workplan</i> , (Weston February 1990).
1990	IRM Work Plan, SCCC Site	SCCC	<i>Final IRM Workplan</i> (Roy F. Weston, Inc., February 1990)
1991	Chromium IRMs, SCCC Site and Diamond Site	Maxus Energy Corporation (Maxus) <sup>7</sup>	<i>Interim Remedial Measures Work Plan</i> (French & Parrello, 1991)
1990-1993	RI and Supplemental RI, SCCC Site	SCCC	<i>Draft Remedial Investigation Report for the Standard Chlorine Chemical Company, Inc. and the Standard Naphthalene Products Inc. Properties, Kearny, New Jersey</i> , (Weston, May 1993)

<sup>7</sup>

Some of the work at the SCCC Site has been conducted under an Administrative Consent Order dated April 17, 1990 entered by NJDEP with Occidental Chemical Corporation (OCC) and Chemical Land Holdings, (CLH) Inc. (now Tierra) relating to COPR (the "Diamond ACO"). Maxus historically had responsibility for overseeing work under the Diamond ACO for OCC, as successor to Diamond Shamrock Chemicals Company.

1996-1997	Focused Remedial Investigation, SCCC Site	SCCC	<i>Focused Remedial Investigation (FRI) Report, Standard Chlorine Chemical Company, Inc. and Standard Naphthalene Products, Inc. Site, Kearny, New Jersey (ERM, Inc., January 1997)</i>
1996	Production Well Closure, SCCC Site	SCCC	<i>Workplan for Production Well Closure (ERM., December 1996)</i>
1997	Proposed Remedial action Plan, Eastern 1/3 SCCC Site	SCCC	<i>Preliminary Remedial Action Plan, Standard Chlorine Chemical Co., Inc. and Standard Naphthalene Products, Inc. Site, Kearny, New Jersey ERM January 1997</i>
1997-1999	Supplemental Remedial Investigation, SCCC Site	SCCC	<i>Supplemental Remedial Investigation Report, Standard Chlorine Chemical Company, Kearny, New Jersey (Key Environmental, Inc., April 1999)</i>
2000	Remedial Action Workplan (Containerized Materials), SCCC Site	SCCC	<i>Remedial Action Workplan (Enviro-Sciences, Inc., June 5, 2000)</i>
2000	Soil/Sediment Sampling and Analysis	SCCC	<i>Enviro-Sciences, Inc., October 23, 2000, Letter to Maria-Franco-Spera (NJDEP)</i>
2000	Septic Tank Closure (NJPDES-DGW) IRM	SCCC	<i>Enviro-Sciences, Inc., August, 2000, Letter to Kevin Marlowe (NJDEP)</i>
2000	Remedial Action Workplan, Baseline Ecological Evaluation, IRM for Northern Outfall, SCCC Site	SCCC	<i>Conceptual Remedial Action Workplan, Standard Chlorine Chemical Company, Inc., Kearny, New Jersey (Enviro-Sciences, Inc., October 1999); Remedial Action Workplan, Standard Chlorine Chemical Company, Inc., Kearny, New Jersey (Enviro-Sciences, Inc., November 2000).</i>
2000	Characterization of Containerized Materials, SCCC Site	SCCC	<i>Enviro-Sciences, Inc., October 23, 2000, Letter to Maria-Franco-Spera (NJDEP)</i>
2001	Remedial Investigation, Diamond Site	Chemical Land Holdings, Inc. (CLH) <sup>8</sup>	<i>Remedial Investigation Report, Site 113 (Diamond Site), (Brown and Caldwell, April 2001)</i>
2002	Surface Water and Sediment Sampling, SCCC Site	EPA	<i>Sampling Report for the Standard Chlorine Site (EPA, 2002)</i>

Attachment 1 (included as Volume III) includes a sample location map and analytical data tables reproduced from the various investigation reports. Also, in May 2005, the Group provided the NJDEP with a series of 41 data maps which comprise a comprehensive summary of the analytical data that have been acquired at both Sites.

<sup>8</sup> *ibid.*

The following sections briefly describe the geologic and hydrogeologic conditions for the Kearny Peninsula and the environmental conditions at the SCCC and Diamond Sites. The discussion of environmental conditions is organized according to areas or media of concern. For each area or medium of concern, the sections present a description of the investigation work performed and a summary of the findings and conclusions regarding the need for further investigation or response action. A description of the existing interim remedial measures (IRM) completed at the Sites is also provided (Section 2.5). The Baseline Ecological Evaluations previously completed for the Sites are summarized and information regarding future ecological activities is presented (Section 2.6). Figure 2-1 shows the general arrangement of both Sites.

## **2.1 AREA GEOLOGY**

Information regarding the regional and site-specific geology has been compiled as a result of the investigations at both sites, as well as through investigation of the adjacent Seaboard Site. The geology in the area consists of coastal plain sediments overlying Triassic-age bedrock. Prior to development, the area consisted of marshlands that bordered the Hackensack River. Fill materials (the “shallow fill unit”) were placed in the coastal marshlands of this region to create property for industrial/commercial development. At the SCCC and Diamond Sites, these fill materials generally consisted of COPR soil and silty sand to depths ranging between 2 to 15 feet below the present grade<sup>9,10</sup>. At the Seaboard Site the fill materials generally consist of heterogeneous granular fill material to depths ranging from 4 to 21 feet in thickness<sup>11</sup>. The original marsh surface, now located beneath the fill materials, consists of silt, humus and peat. This layer is regionally referred to as the “meadow mat” and is typically two to eight feet thick across the peninsula. The upper surface of the meadow mat is undulating rather than planar.

A sand unit (the “deeper sand unit”) is present beneath the meadow mat and is generally less than ten feet thick at the SCCC and Diamond Sites. With the exception of the eastern section of the Seaboard Site, this deeper sand layer is continuous across the peninsula. At the Seaboard Site, this unit has a maximum thickness of 20 feet in the Central Area of the Site. The deeper sand unit is absent in the eastern portion of the Seaboard Site where it has been replaced by a low permeability silt to silty clay unit.

A varved clay unit is present beneath the deeper sand unit. The varved clay unit is continuous beneath the peninsula. This unit is at least 40 feet thick beneath the Seaboard site. The thickness of this unit beneath the SCCC and Diamond Sites is estimated at greater than 40 feet based on subsurface data acquired from the western section of the Seaboard Site. The vertical permeability of the varved clay unit, based on laboratory testing of Shelby tube samples collected at the Seaboard Site, averaged approximately  $2.5 \times 10^{-8}$  centimeters per second (cm/sec).

<sup>9</sup> Roy F. Weston, Inc., May 1993, Draft Remedial Investigation for the Standard Chlorine Chemical Company, Inc. and the Standard Naphthalene Products Inc. Properties, Kearny, New Jersey.

<sup>10</sup> Brown and Caldwell, April 2001, Remedial Investigation Report Site 113 (Diamond Site).

<sup>11</sup> Key Environmental, Inc., April 1998, Remedial Action Work Plan Former Koppers Seaboard Site, Kearny, New Jersey.

Figure 2-2 is a cross-section showing the shallow subsurface geologic conditions beneath the SCCC Site. Figures 2-3, 2-4, and 2-5 present a cross-section location map and cross-sections showing the shallow geologic conditions beneath the Diamond Site.

A glacial till unit is present beneath the varved clay. Bedrock lies directly beneath the glacial till unit at depths ranging from 70 feet in the western section of the Seaboard Site to greater than 100 feet in the eastern section of the Seaboard Site. The depth to bedrock has not been ascertained beneath the SCCC and Diamond Sites but is believed to be comparable to that observed in the western section of the adjacent Seaboard Site.

## **2.2 AREA HYDROGEOLOGY**

Two separate shallow groundwater-bearing units have been the focus of the groundwater investigation activities performed at the sites: 1) the shallow fill unit; and, 2) the deeper sand unit that underlies the meadow mat and overlies the varved clay. The water table at the three sites occurs in the shallow fill material overlying the meadow mat. The meadow mat acts as a basal semi-confining unit that limits, but does not completely eliminate, the hydraulic connection between the shallow fill materials and the underlying deeper sand unit. Potentiometric data acquired from nested well locations during low tide indicate the existence of a downward vertical gradient between the shallow fill material and the deeper sand layer. Groundwater within the shallow fill material exists under unconfined conditions. Previous studies have indicated that the groundwater within the shallow fill material is not tidally influenced to a significant degree.

Groundwater flow in the shallow fill unit at the SCCC and Diamond Sites appears to be influenced by recharge and discharge phenomena. A potentiometric mound, resulting from recharge from precipitation, exists in the shallow fill material in the vicinity of the lagoons at the SCCC Site. Groundwater flows radially away from this potentiometric mound in the lagoon area. Similarly, a potentiometric mound exists in the unpaved portions of the Diamond Site located in the north-central and northwestern sections of the Site, where a soil cover serves as an IRM. Groundwater flow in the southern portion of the Diamond Site and the northern portion of the SCCC Site is toward a 48-inch diameter storm sewer located along the boundary between the two Sites. It is possible that, based on evaluation of the potentiometric data, the storm sewer (and/or the backfill surrounding it) may serve as a localized discharge point for groundwater in the fill unit. An evaluation of the storm sewer was proposed by Tierra in its' February 2006 response to comments on the Diamond Site RI. This evaluation has been completed. Based upon this evaluation, Tierra submitted, in October 2006, an Interim Remedial Measures Workplan. Repairs for the storm sewer are recommended in the October 2006 IRM Workplan. To date, NJDEP has not acted on this IRM Workplan.

Beyond the influence of this mound and the potentiometric low in the vicinity of the sewer, groundwater flow in the shallow fill material at the SCCC Site is primarily to the south-southeast toward a drainage ditch in the southern portion of the SCCC Site. Groundwater in the shallow fill unit in the eastern portion of the SCCC and Diamond Sites flows to the east and discharges to the Hackensack River. The average horizontal hydraulic gradient in the shallow fill material at

the SCCC Site is 0.0063 feet per foot (ft/ft)<sup>12</sup>. Figure 2-6 is a potentiometric surface contour map for the shallow fill unit on the SCCC Site. Figure 2-7 is a potentiometric surface contour map for the shallow fill unit on the Diamond Site.

Groundwater in the deeper sand unit beneath the meadow mat exists under semi-confined conditions. The underlying varved clay acts as an effective barrier to the downward migration of groundwater from this unit. Groundwater flow in the deeper sand unit is primarily to the south-southeast, sub-parallel to the direction of flow in the river. Horizontal hydraulic gradients in the deeper sand unit are relatively flat, ranging from 0.002 to 0.008 ft/ft. Figure 2-8 is a potentiometric surface contour map for the deeper sand unit on the SCCC Site, and Figure 2-9 is a potentiometric surface contour map for the deeper sand unit on the Diamond Site. Based on previously conducted slug tests, the average horizontal hydraulic conductivity of this unit at the SCCC Site is 5.34 feet/day ( $1.9 \times 10^{-3}$  cm/sec).

Groundwater within the deeper sand unit is tidally influenced to a limited extent. Fluctuations in potentiometric surface elevations that are correlated to tides in the Hackensack River have been observed in wells located immediately adjacent to the river. The limited tidal influence has not been observed to create significant changes in groundwater flow directions.

## **2.3 SCCC SITE REMEDIAL INVESTIGATION SUMMARY**

### **2.3.1 Physical Setting**

The SCCC Site occupies an area of approximately 25 upland acres. The Site is bounded by the Hackensack River to the northeast, Belleville Turnpike to the southwest, the Diamond Site to the north and northwest, and the Seaboard Site to the southeast. Railroad tracks were formerly present at the southwestern corner of the Site. A north-south trending railroad right-of-way, the site of a former rail spur which is currently owned by the Hudson County Improvement Authority, is located west of the lagoon area. The general Site layout is shown on Figure 1-2.

### **2.3.2 Site History**

A detailed description of the Site operational history is provided in the RI Report prepared by Roy F. Weston, Inc. (Weston)<sup>13</sup>. In summary, manufacturing operations were conducted at the Site by various entities between 1916 and 1993, and included the refining of naphthalene, the manufacture of products from naphthalene, naphthalene derivatives and dichlorobenzenes, the formulation of drain cleaning products, and, on a limited basis during the mid-1970s, the processing of trichlorobenzene. The naphthalene refining operations were conducted in the eastern two-thirds of the Site. The manufacture of dichlorobenzene products and the formulation

<sup>12</sup> Roy F. Weston, Inc., May 1993, Draft Remedial Investigation for the Standard Chlorine Chemical Company, Inc. and the Standard Naphthalene Products Inc. Properties, Kearny, New Jersey.

<sup>13</sup> Roy F. Weston, Inc. May 1993, Draft Remedial Investigation for the Standard Chlorine Chemical Co., Inc. and Standard Naphthalene Products, Inc. Properties, Kearny, New Jersey.

of drain cleaning products occurred in the western one-third of the property. Dichlorobenzene and trichlorobenzene processing occurred in the northeastern section of the Site.

### **2.3.3 Area of Concern Summary**

As previously discussed, various investigations have been performed at the SCCC Site. Analytical data acquired during these investigations are provided in Attachment 1. A site map showing sample locations is also provided in Attachment 1 for reference. In addition, the Group previously submitted a series of 41 data maps, which visually summarize the nature and extent of constituents in environmental media at the Sites, to the NJDEP in May 2005.

The following sections summarize the site conditions by individual Areas of Concern and reference the specific section of Attachment 1 that contains data relative to that Area of Concern. For the SCCC Site, the Areas of Concern are as follows:

- Area of Concern 1 – Lagoon Solids;
- Area of Concern 2 – Western Area Soil;
- Area of Concern 3 – Eastern Area Soil;
- Area of Concern 4 – Shallow Fill Unit Groundwater;
- Area of Concern 5 – Deeper Sand Unit Groundwater;
- Area of Concern 6 – Bedrock Groundwater;
- Area of Concern 7 – Dense Non-Aqueous Phase Liquid (DNAPL)
- Area of Concern 8 – Drainage Ditch Surface Water;
- Area of Concern 9 – Hackensack River Surface Water;
- Area of Concern 10 – Drainage Ditch Sediments;
- Area of Concern 11 – Hackensack River Sediments; and,
- Area of Concern 12 – Transformer Area

The following subsections discuss each of the Areas of Concern. Brief discussions of the scope of historical investigations are provided. The results of the historic investigations and any planned activities are discussed at the end of each subsection.

#### **2.3.3.1 SCCC Site Area of Concern 1 – Lagoon Solids**

Residual materials, comprised of solids and oily materials, are currently present in the lagoon located in the eastern portion of the property. This subsection summarizes the investigative activities conducted to determine the extent and/or chemical composition of lagoon solids.

#### **Previous Investigations**

*Hydrogeologic Investigation (Weston 1984)* - One sediment sample was collected from the western section and one from the eastern section of the lagoon as part of this investigation. The samples were analyzed for pH, total chromium (Cr), hexavalent chromium (Cr(VI)), and Extraction Procedure (EP) Toxicity metals.



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*Phase II Dioxin Investigation (NJDEP, 1985)* – Two solid samples were collected for Dioxin analysis. One sample was collected from the western section and one sample was collected from the eastern section of the lagoon as part of this NJDEP investigation. Based on the analytical results, which indicated the presence of Dioxin in one of the samples, the NJDEP directed SCCC to conduct staged Dioxin investigations.

*Stage I, II, and III Dioxin Investigations (Weston, 1987 and 1988)* - In February and March 1987, SCCC performed a Stage I Dioxin investigation that included collection of samples from borings located in a grid fashion across the lagoon. Samples were typically collected from four separate depths at each of the 20 locations. The two deep samples from each location were archived for future analysis if the shallower samples revealed the presence of Dioxin. As a result of the presence of Dioxin in some of the Stage I samples, the Stage II and Stage III investigations were completed, which consisted of the analysis of these archived samples. As part of this investigation, a total of eighty (80) samples of the lagoon solids were analyzed for Dioxin.

*Remedial Investigation (Weston, 1993)* - Two solid and two aqueous samples were collected from the lagoons and analyzed for Target Compound List (TCL) volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), PCBs, and Target Analyte List (TAL) metals.

### **Results of Previous Investigations**

According to the Weston RI Report, the lagoons occupy a surface area of approximately 33,000 square feet and have an average solids thickness of five to six feet. Thus, the lagoons contain approximately 7,300 cubic yards of solid material.

Attachment 1 includes a sample location map and Section A.1 of Attachment 1 includes data tables summarizing the results of the historic analyses of the lagoon solids. Testing conducted during the RI indicates that the lagoon material is comprised primarily of naphthalene, with lesser amounts of other volatile (benzene, ethylbenzene, and toluene) and semi-volatile organic compounds (polynuclear aromatic hydrocarbons and phenols). Hexavalent chromium was not detected in the lagoon solids. The results of the Dioxin analyses indicate the presence of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) in 46 of the 82 samples analyzed. Review of the SCCC Site process descriptions and the listed hazardous waste definitions in Subpart D of 40 Code of Federal Regulations (CFR) Part 261 indicates that the materials within the lagoon are not a RCRA listed waste.

### **Planned Activities**

As described in Section 3.4, it is proposed that the lagoon contents will be addressed via dewatering and backfilling as part of the IRAW implementation. Design data acquisition consists of the collection of geotechnical data to characterize the compressibility of the meadow mat to support settlement analysis. In addition, waste classification information will be obtained to characterize the lagoon contents in the event that excavation and offsite treatment/disposal of

the lagoon contents is selected as a final remedy. Water quality information will be obtained from the lagoon to support analysis of treatment options. A previously proposed solidification study for the lagoon contents will be implemented as part of the future RI activities and solidification will ultimately be evaluated as a potential final remedy for the lagoon contents. The NJDEP waste classification and associated information will be used to identify potential treatment and/or disposal facilities that are legally able and willing to accept the materials for treatment/disposal.

### **2.3.3.2 SCCC Site Area of Concern 2 – Western Area Soil**

The investigative activities conducted to characterize the soils that are located west of the railroad right-of-way on the SCCC Site are as follows:

#### **Previous Investigations**

*Hydrogeologic Investigation (Weston 1984)* - Eleven soil samples were collected during monitoring well installation in the western portion of the SCCC Site. The samples were analyzed for pH, total chromium, hexavalent chromium, and EP Toxicity metals. In addition, three of the soil samples were split with the NJDEP and analyzed for VOCs.

*Phase II Dioxin Investigation (NJDEP, 1985)* - In May 1985, six soil samples were collected for Dioxin analysis from the western portion of the site. Areas investigated by the NJDEP included the following:

- Storage tanks in the western section of the Site near Building 2;
- Rail spur south of Building 2;
- Areas receiving drainage from southwest section of the Site (2 samples);
- Open area devoid of vegetation just west of the railroad right-of-way; and,
- Rail spur south of the warehouse.

The results of these analyses indicated that 2,3,7,8-TCDD was not present in any of the six samples.

*Interim Remedial Measures Sampling (French & Parrello, 1991)* - Prior to implementation of the IRMs at the SCCC Site (Section 2.5.1), additional soil sampling was performed to determine the limits of the COPR-impacted surface soil. Twenty-three surface soil samples were collected from the western portion of the SCCC Site and analyzed for hexavalent and total chromium.

*Remedial Investigation (Weston, 1993)* - Seven test pits were excavated to determine the thickness of the COPR soil. One sample of the soil directly underlying the COPR soil was collected for analysis at each of the seven locations. These samples were analyzed for hexavalent chromium.

Three soil borings were completed to the top of the varved clay unit at locations adjacent to Building 2 where above-ground tanks were once located and chemicals for production or shipment were unloaded/loaded. Six soil samples (two from each of the borings) were analyzed for VOCs, SVOCs, pesticides/PCBs, and metals.

*Focused Remedial Investigation (ERM 1997)* - A total of three soil borings were advanced to the top of the varved clay unit to determine the presence/absence of DNAPL, and to provide information regarding the topography of the meadow mat and varved clay. Three discrete soil samples were submitted for analysis of VOCs and “lighter weight” SVOCs.

*Supplemental Remedial Investigation (Key Environmental, Inc., 1999)* - Two borings were completed to the varved clay unit in the western section of the site to investigate the possible presence of a surficial source of contamination in this area. Three soil samples from each of the borings were analyzed for SVOCs.

### **Results of Previous Investigations**

Attachment 1 includes a sample location map and Section A.2 of Attachment 1 includes data tables summarizing the results of the historic analyses of the SCCC Site. The results of these activities indicate the presence of chlorobenzene, 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, and naphthalene at concentrations greater than the New Jersey Non-Residential Direct Contact Soil Cleanup Criteria (NRDCSCC). In addition, surface soils in the western portion of the Site were also analyzed for hexavalent chromium during an investigation conducted by Maxus. The results of these analyses show the presence of hexavalent chromium at concentrations greater than the NRDCSCC at several locations.

### **Planned Activities**

As described in Section 3.6, soils impacted by organic compounds and COPR soils will be addressed via construction of an interim surface cover over portions of the Site. Surface soils in the western areas of the Site have existing IRM covers. Potential subsurface impacts from organic and inorganic constituents will be addressed by the barrier wall and hydraulic control systems. A description of the associated design data acquisition activities is included in Section 4.6.

#### **2.3.3.3 SCCC Site Area of Concern 3 – Eastern Area Soil**

The following summarizes the investigative activities conducted to characterize the soils located east of the railroad right-of-way on the SCCC Site:

### **Previous Investigations**

*Hydrogeologic Investigation (Weston 1984)* - Six soil samples were collected during monitoring well installation in the eastern portion of the SCCC Site. The samples were analyzed for pH,

total chromium, hexavalent chromium, and EP Toxicity metals. In addition, two of the soil samples were split with the NJDEP and analyzed for VOCs.

*Phase II Dioxin Investigation (NJDEP, 1985)* - In May 1985, six soil samples were collected for Dioxin analysis. Areas investigated by the NJDEP included the following:

- Rail siding for naphthalene operations in the northern section of the site, just east of the railroad right-of-way (2 samples);
- Dichlorobenzene storage tanks in the eastern section of the Site;
- Trichlorobenzene storage tanks in the eastern section of the Site;
- Area east of the lagoon; and,
- Open area devoid of vegetation in the eastern section of the Site.

The results of these analyses indicated that 2,3,7,8-TCDD was not present in five of the six samples. The only soil sample that contained a detectable concentration of 2,3,7,8-TCDD was collected in the former dichlorobenzene tank farm area.

*Stage I, II, and III Dioxin Investigations (Weston, 1987 and 1988)* - Surface and subsurface soil samples were collected for Dioxin analyses from seven locations around the perimeter of the lagoon and from four locations along the Hackensack River bank. 2,3,7,8-TCDD was not detected in any of these samples. Additional surface soil sampling was conducted in the area between the dichlorobenzene tank farm and the distillation building, and in the area south of the lagoon. No 2,3,7,8-TCDD was detected except in one of the samples collected between the dichlorobenzene tank farm and the distillation building.

*Interim Remedial Measures Sampling (French & Parrello, 1991)* - Prior to implementation of the IRMs at the SCCC Site (Section 2.5.1), additional soil sampling was performed at the request of Maxus to determine the limits of the chromium impacted surface soil. Thirteen surface soil samples were collected from the eastern portion of the SCCC Site and analyzed for hexavalent chromium and total chromium.

*Remedial Investigation (Weston, 1993)* - Ten shallow soil samples were collected from locations around the former storage tanks adjacent to the distillation building in the eastern section of the SCCC Site. These samples were analyzed for VOCs and SVOCs. One test pit was excavated to determine the thickness of the COPR soil. One sample of the soil directly underlying the COPR soil was collected for analysis. The sample was analyzed for hexavalent chromium.

*Focused Remedial Investigation (ERM 1997)* - A total of 11 soil borings were advanced to the top of the varved clay unit to determine the presence/absence of DNAPL and to provide information regarding the surfaces of the meadow mat and varved clay. Five discrete soil samples were submitted for analysis of VOCs and "lighter weight" SVOCs.

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### **Results of Previous Investigations**

Attachment 1 includes a sample location map and Section A.2 of Attachment 1 includes data tables summarizing the results of the historic analyses of the SCCC Site soils. The results of these activities indicate the presence of chlorobenzene, 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, and naphthalene at concentrations greater than the NRDCSCC.

The investigation of surface soils in the eastern portion of the Site show the presence of hexavalent chromium at concentrations greater than the NRDCSCC in certain areas located to the north and south of the lagoons. The presence of 2,3,7,8-TCDD in soil is limited to surface soil in the vicinity of the former dichlorobenzene storage tank area.

### **Planned Activities**

As described in Section 3.6, soils impacted by organic compounds and COPR soils will be addressed via construction of an interim surface cover over portions of the Site. A description of the proposed interim surface cover and associated design data acquisition activities are provided in Sections 3.6 and 4.6. Potential subsurface impacts from organic and inorganic constituents will be addressed by the barrier wall and hydraulic control systems.

#### ***2.3.3.4 SCCC Site Area of Concern 4 – Shallow Fill Unit Groundwater***

The following summarizes the investigative activities conducted to characterize the shallow fill unit groundwater on the SCCC Site:

### **Previous Investigations**

*Hydrogeologic Investigation (Weston 1984)* - Five monitoring wells were installed in the shallow fill unit (8 to 10 feet deep). Groundwater samples from each of the wells were analyzed for VOCs, base/neutral extractable organic compounds, hexavalent chromium, and total chromium.

*Remedial Investigation (Weston 1993)* - Five additional monitoring wells were installed in the shallow fill unit. Groundwater samples were collected from these monitoring wells and were analyzed for TCL VOCs, SVOCs, PCBs, TAL metals, and hexavalent chromium. In addition, samples from four monitoring wells adjacent to the lagoons were analyzed for Dioxin.

### **Results of Previous Investigations**

Attachment 1 includes a sample location map and Section A.3 of Attachment 1 includes data tables summarizing the results of the historic analyses of the shallow fill unit groundwater. The results of these activities indicate that concentrations of volatile organic compounds (VOCs), chlorobenzene and dichlorobenzene isomers, and semi-volatile organic compounds (SVOCs), naphthalene and 1,2,4-trichlorobenzene, and hexavalent chromium in groundwater in the shallow

fill unit exceed the NJDEP Groundwater Quality Standards (GWQS) for a Class IIA aquifer. 2,3,7,8-TCDD was not detected in the shallow fill unit groundwater samples. The distribution of DNAPL in the shallow unit is described in Section 2.3.3.7.

### **Planned Activities**

Interim response action components for groundwater in the shallow fill unit include installation of a fully-enclosing barrier wall (Section 3.1), installation of a groundwater extraction and treatment (hydraulic control) system (Section 3.2), installation of a DNAPL recovery system (Section 3.3), and dewatering and backfilling of the lagoons (Section 3.4). The performance of the response action will be evaluated through a post-construction hydraulic monitoring program. The hydraulic monitoring program will be developed during the detailed design. Results of the post-construction hydraulic monitoring will be reported to the NJDEP. Should the monitoring program indicate unsatisfactory performance, additional response actions will be evaluated and implemented.

#### ***2.3.3.5 SCCC Site Area of Concern 5 – Deeper Sand Unit Groundwater***

The following summarizes the investigative activities conducted to characterize the deeper sand unit groundwater on the SCCC Site:

### **Previous Investigations**

*Hydrogeologic Investigation (Weston 1984)* - Five monitoring wells were installed in the deeper sand unit (18 to 20 feet deep). Groundwater samples from each of the wells were analyzed for VOCs, base/neutral extractable semi-volatile organic compounds, and hexavalent and total chromium.

*Remedial Investigation (Weston 1993)* - Fifteen (15) monitoring wells were installed in the deeper sand unit. Groundwater samples were collected from these monitoring wells and were analyzed for TCL VOCs, SVOCs, PCBs, TAL metals, and hexavalent chromium. In addition, samples from three monitoring wells adjacent to the lagoons were analyzed for 2,3,7,8-TCDD. A second round of sampling was conducted by Weston as part of the RI. Samples from nine wells installed within the deeper sand unit were analyzed for VOCs, SVOCs, chromium and lead.

*Supplemental Remedial Investigation (KEY 1999)* - Two additional deeper sand unit monitoring wells were installed. Groundwater samples were collected from the two new monitoring wells and were analyzed for TCL SVOCs.

### **Results of Previous Investigations**

Attachment 1 includes a sample location map and Section A.3 of Attachment 1 includes data tables summarizing the results of the historic analyses of the deeper sand unit groundwater. The

results of these activities indicate that organic constituents of interest (COIs) in groundwater in the deeper sand unit are widely distributed across the Site. Chlorobenzene, dichlorobenzene isomers, and naphthalene were detected in the deeper sand unit groundwater at concentrations that exceed the NJDEP GWQS for a Class IIA aquifer. Chlorinated VOCs have also been detected in the deeper sand unit along the northern property boundary. Concentrations of total chromium in the deeper sand unit groundwater also exceed the Class IIA GWQS. However, no hexavalent chromium has been detected in the deeper sand unit.

### **Planned Activities**

Further investigation is necessary to define the extent of dissolved phase constituents in the deeper sand unit. This investigation will be implemented at a later date during supplemental RI activities. As described in Section 2.3.3.7, additional investigation is also required to delineate the extent of DNAPL in the deeper sand unit. As a result, additional activities will ultimately be conducted in conjunction with a DNAPL investigation to delineate the extent of dissolved-phase constituents (and DNAPL) in the deeper sand unit as part of the RI. As described in Section 4.3, DNAPL recovery will commence in areas currently known to contain DNAPL as a component of the IRA. Expansion of the DNAPL recovery system may be conducted at a later date as part of the final remedy, pending RI completion.

Interim response action components for groundwater in the deeper sand unit include installation of a fully-enclosing barrier wall that is keyed into the varved clay (Section 3.1) and installation of a DNAPL recovery system (Section 3.3). The performance of the response action will be evaluated through a post-construction monitoring program and evaluation of operations data. Should the monitoring program or operations data indicate unsatisfactory performance, additional response actions will be evaluated and implemented.

#### ***2.3.3.6 SCCC Site Area of Concern 6 – Bedrock Groundwater***

### **Previous Investigations**

Groundwater samples were collected for analysis in 1998 prior to sealing the former production well at the SCCC Site. The purpose of this analysis was to determine appropriate management options for groundwater displaced from the well during the abandonment procedure.

### **Results of Previous Investigations**

The results of the deep groundwater sample analyses are presented in Section A.4 in Attachment 1. Certain high molecular weight polynuclear aromatic hydrocarbon (PAH) compounds and metals (lead and chromium) were reported at concentrations slightly greater than the NJDEP Class II-A GWQS.

Based upon the low mobility of the constituents detected in the production well samples and the absence of the more mobile and prevalent constituents present in the shallow aquifers (e.g.,

naphthalene and dichlorobenzenes), it is likely that the detections resulted from the introduction of surficial fill (or soil) particulates into the water column through the well bore. More than 40 feet of low permeability varved clay underlies the entire site and separates the deeper sand unit and the upper section of the bedrock unit. Also, as indicated previously, the vertical permeability of this unit is on the order of  $10^{-8}$  cm/sec. The thickness, continuity and low permeability of the varved clay unit preclude the advective transport of dissolved constituents through the underlying strata to the bedrock unit.

### **Planned Activities**

The production well was sealed in January 1999 as directed by the NJDEP. Further investigation of bedrock groundwater quality is not necessary as the data clearly demonstrate that advective transport of dissolved constituents through the varved clay layer has not occurred. No remedial action is necessary for this area of concern.

#### ***2.3.3.7 SCCC Site Area of Concern 7 – DNAPL***

### **Previous Investigations**

As part of the Focused RI, all monitoring wells were checked for the presence of DNAPL. DNAPL was detected in four monitoring wells screened in the deeper sand unit. The apparent thicknesses of the DNAPL accumulated in these wells were measured. A table summarizing these measurements is included in Section A.5 in Attachment 1. Samples of the DNAPL were also collected for chemical characterization. The results of these analyses indicate the DNAPL is comprised primarily of 1,2,4-trichlorobenzene, naphthalene and the dichlorobenzene isomers. A table summarizing these results is also included in Section A.5 of Attachment 1. A sample location map is provided in Attachment 1 for reference.

The presence of DNAPL at the Site was further evaluated during the Supplemental RI. Delineation of the extent of DNAPL was completed using laser-induced fluorescence (LIF) technology. Thirty-one soundings were advanced to the varved clay at locations across the Site. At four locations where the LIF data were deemed inconclusive in terms of DNAPL absence/presence, confirmatory soil borings were completed.

A comprehensive evaluation of all available information regarding occurrence of DNAPL was completed as part of the SRI data evaluation process. In addition to the LIF readings, information reviewed and considered in this evaluation included boring log descriptions, DNAPL thickness measurements, soil analytical data and groundwater analytical data.

### **Results of Previous Investigations**

The presence of DNAPL in the shallow fill unit above the meadow mat appears, for the most part, to be limited to the area immediately surrounding the lagoons and the area adjacent to Building 4. It does not appear that significant lateral migration of DNAPL in the shallow fill unit



has occurred based on review of historic information (boring logs, groundwater analytical results) and the LIF data.

The SRI results indicate that DNAPL is more widely distributed in the deeper sand unit than in the shallow fill unit, and is present directly on the top of the varved clay. This indicates that DNAPL is present from west of the lagoon area to the vicinity of the former railroad right-of-way. Also, DNAPL is present in the deeper sand unit at the northern property boundary and in the area between the lagoons and the river. DNAPL was also inferred to be present in the area south of the lagoons and along the southwest property boundary in the vicinity of Buildings 2 and 4.

### **Planned Activities**

Interim response action components for the DNAPL in the shallow fill unit and deeper sand unit include the construction of the barrier wall system (Section 3.1) and DNAPL collection system (Section 3.3). Data to support the design of the barrier wall system will be acquired as described in Section 4.1. Section 4.3 describes data collection efforts for the DNAPL recovery system. As previously indicated, the DNAPL recovery system will focus on known DNAPL areas and may be expanded at a later date as part of the final remedy based upon the results of additional remedial investigation,

#### ***2.3.3.8 SCCC Site Area of Concern 8 – Drainage Ditch Surface Water***

### **Previous Investigations**

In October 2002, the EPA collected surface water samples for analysis from 17 locations within the Southern Drainage ditch, swales that discharge to the ditch, and a “wetland” area on the adjacent Seaboard Site that is hydraulically connected to the ditch. The surface water sampling locations are shown on Figure 2-11. The samples were analyzed for TCL VOCs, TCL SVOCs, TAL metals, pesticides and PCBs. The results of these analyses are presented in the *Sampling Report for the Standard Chlorine Site* (EPA, 2002).

### **Results of Previous Investigations**

Attachment 1 includes a sample location map and Section A.6 of Attachment 1 includes data tables summarizing the results of the analyses of the drainage ditch surface water. The results of these analyses indicate the presence of chromium at a concentration greater than the Surface Water Quality Criteria (SWQC) in one sample (SW-12) that was collected immediately adjacent to the stone-covered area where Maxus constructed an IRM for COPR soils. Chromium concentrations in samples collected downstream of this location are less than the SWQC. The 1,2,4-trichlorobenzene concentration in the surface water sample collected furthest from the river (SW-21) also exceeded its SWQC. Concentrations of 1,2,4-trichlorobenzene in the downstream samples are less than the SWQC.

Other than the aforementioned two exceedances, concentrations of COIs in the drainage ditch surface water samples collected by EPA are less than the respective SE2 SWQC.

### **Planned Activities**

The sampling conducted by EPA addressed all onsite surface water drainage ways. Therefore, no further investigation of the surface water in this area of concern is warranted. As part of the interim response action, the ditch network will be closed, in association with the interim surface cover construction (Section 3.6), and will be replaced with a new stormwater management system. The stormwater management system will be designed and constructed such that it will receive only stormwater run-off from covered or un-impacted areas. By elimination of potential introduction of groundwater and contaminated surface flow into the stormwater management system, the potential for future impact to surface water and sediments will be mitigated.

#### ***2.3.3.9 SCCC Site Area of Concern 9 – Hackensack River Surface Water***

### **Previous Investigations**

EPA collected four samples of water discharging to the Hackensack River during its October 2002 investigation of the SCCC Site. Three locations adjacent to the SCCC Site (designated SW-1 through SW-3) were sampled. The fourth location (SW-4) was located north of the SCCC Site and was designated by EPA as a “background” location. Sample locations are shown on Figure 2-11.

Split surface water samples were collected by Tierra at these locations. The split samples were analyzed for total and hexavalent chromium.

### **Results of Previous Investigations**

Attachment 1 includes a sample location map and Section A.6 of Attachment 1 includes data tables summarizing the results of the analyses of the Hackensack River surface water. A sample of surface water seepage along the bank of the Hackensack River collected by EPA (SW-01) contained total chromium at a concentration of 3 mg/L, which is slightly less than the NJDEP Class SE2 SWQC of 3.23 mg/L. Total chromium was measured at concentrations of 2.09 and 0.855 mg/L, respectively, in the primary and duplicate Tierra split samples collected from this location. Hexavalent chromium was not detected in the Tierra split samples collected from this location at a detection limit of 0.010 mg/L.

Chlorinated aromatic hydrocarbons were also detected in these samples. However, concentrations of these constituents are much less than their respective SE2 SWQC. Naphthalene concentrations in the surface water samples collected along the bank of the river ranged from less than the method detection limit (SW-01) to 0.045 mg/L (SW-02). There is no SWQC for naphthalene specified in N.J.A.C 7:9B.

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## **Planned Activities**

No further investigation of the discharges to the surface water in the river is necessary, as no exceedances of the SWQC have been reported.

Through the construction of the barrier wall system (Section 3.1) along the entire riverfront, installation of the hydraulic control system (Section 3.2), and installation of an interim surface cover and stormwater management system (Section 3.6), the potential for future impact to the river via discharges to surface water will be eliminated.

### ***2.3.3.10 SCCC Site Area of Concern 10 – Drainage Ditch Sediment***

## **Previous Investigations**

The EPA collected sediment samples at the same 17 locations where surface water samples were collected within the drainage ditch network and the hydraulically connected wetland on the Seaboard Site (Figure 2-11). For discussion purposes only, comparison of the sediment concentration is made to the NJDEP Marine/Estuarine Screening Guidelines, Effects Range-Median (ER-M) criterion, as these criteria are used for screening purposes, are not enforceable environmental standards, and should not be construed as remediation standards that are applicable to these Sites.

## **Results of Previous Investigations**

Attachment 1 includes a sample location map and Section A.6 of Attachment 1 includes data tables summarizing the results of the analyses of the drainage ditch sediment samples. Chromium concentrations exceed the ER-M in all 17 samples. Naphthalene concentrations greater than the ER-M were reported in nine (9) of the 17 samples. Dioxin concentrations in the sediment samples collected on the SCCC Site were in many instances (eight of the seventeen samples collected within the ditch system), less than the background Dioxin concentration measured at the EPA-designated background location (S-04) within the river (0.000008 mg/kg). Of the nine samples where Dioxin concentrations exceeded the background concentration, only four samples contained Dioxin concentrations greater than 0.000080 mg/kg. Three of these samples were taken in the open water “wetland” which is hydraulically connected to the ditch and located on the adjacent Seaboard Site. Dioxin concentrations in the remaining five samples were only slightly greater than the background concentration and ranged from 0.000009 to 0.000050 mg/kg.

The Dioxin investigation completed by the NJDEP identified only two areas on the SCCC Site where Dioxin was present (lagoon solids and the former distillation building area). Migration of Dioxin-impacted media from these areas to drainage ditches is unlikely.

Dioxin was not detected in any of the samples that were collected from monitoring wells installed around the perimeter of the lagoon. The results of groundwater analyses conducted by

Weston during the RI are indicative of the immobility of Dioxin in groundwater. The lagoons were constructed below the surrounding ground elevation. Hence, it is unlikely that Dioxin from the lagoon solids would have been transported to the sediments via storm water runoff. The solubility of Dioxin in water is extremely low and it is immobile in groundwater due to its affinity for adsorption to organic carbon in the aquifer matrix. As a result, transport of Dioxin to sediments by a groundwater migration pathway is not viable.

The topography surrounding the distillation building is relatively flat, and is therefore not conducive to transport of impacted soil via overland flow. The distance from the distillation building to the branch of the southern ditch is approximately 500 feet and as a result of the relatively flat topography, it is unlikely that Dioxin from this area has been transported to the sediments via overland flow. In addition, because of the low solubility and low mobility of Dioxin in groundwater, it is unlikely that the Dioxin was transported to the sediments via groundwater migration and discharge. The absence of Dioxin in surface soil samples collected between drainage ditches and the potential source areas where Dioxin was previously detected (i.e., the lagoon and the distillation building area) suggest that migration of Dioxin from these areas has not occurred.

### **Planned Activities**

The sampling conducted by EPA provides chemical characterization of the sediment along the entire lengths of the drainage ditches. As part of the interim response action, the ditch network will be closed in conjunction with site preparation activities (Section 3.7), in association with the interim surface cover construction (Section 3.6), and will be replaced with a new stormwater management system. Closure of the ditch is also necessary to enable construction of the slurry wall. To facilitate the closure of the ditch, the soft soil will be excavated. The excavated soft soils will be handled in accordance with the Materials Management Flow Chart (Figure 1-3). The excavated soft soils will either be consolidated onsite, transported off site for treatment/disposal, or a combination thereof. As part of the design data acquisition activities, the thickness and volume of loose sediment will be determined by probing. In addition, waste classification sampling and analysis will be completed. As indicated in Section 2.6.1, the Group will prepare an updated BEE as part of the future RI Reporting for the SCCC Site.

#### ***2.3.3.11 SCCC Site Area of Concern 11 – Hackensack River Sediment***

### **Previous Investigations**

The near-shore sediments in the Hackensack River were characterized via sampling and analyses conducted by Enviro-Sciences, Inc. (ESI)<sup>14</sup> in 2000 and by EPA in 2002. Sample locations are shown on Figure 2-11.

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<sup>14</sup> Enviro-Sciences, Inc., November 2000, Remedial Action Workplan.

ESI collected surficial sediment samples from nine locations in the Hackensack River adjacent to the site. These samples were analyzed for VOCs, base/neutral extractable organic compounds (including a scan for Dioxin), priority pollutant metals, hexavalent chromium, total organic carbon (TOC), and particle size distribution. The analytical data were provided to the NJDEP in a submittal dated October 23, 2000.

The EPA collected sediment samples at three locations adjacent to the SCCC Site (designated S-1 through S-3). A fourth location (S-4) was located north of the SCCC Site and was designated by EPA as a “background” location. Sediment samples collected by EPA were analyzed for TCL VOCs, TCL SVOCs, TAL metals, pesticides and PCBs, dioxins and furans, and TOC.

Tierra collected split sediment samples at the locations sampled by EPA and analyzed the samples for hexavalent chromium by EPA SW-846 Methods 3060/7199.

### **Results of Previous Investigations**

Attachment 1 includes a sample location map and Section A.6 of Attachment 1 includes data tables summarizing the results of the analyses of the Hackensack River sediment. The results of the sampling and analyses completed by ESI and EPA indicate that chromium concentrations in the near-shore Hackensack River surficial sediments exceed the ER-M criterion at eight of nine locations sampled by ESI and in each of the three (3) samples collected by EPA. Hexavalent chromium was not detected in any of the split samples analyzed by Tierra. Naphthalene concentrations exceed the ER-M criterion in eight (8) of these twelve (12) samples. Dioxin was detected in the three surficial sediment samples collected by EPA at concentrations ranging from 0.000040 mg/kg to 0.000096 mg/kg.

### **Planned Activities**

Near-shore sediments in the Hackensack River will be removed by excavation and will be managed in accordance with the materials management decision flowchart (Figure 1-3). Additional sampling and analysis will be performed during the IRAW implementation to support waste classification including preparation of a waste classification determination request form to be submitted to the NJDEP Waste Classification Unit. Conditioning requirements for river sediments will be evaluated, as necessary, during the course of the IRAW implementation (Section 4.5).

#### ***2.3.3.12 SCCC Site Area of Concern 12 – Transformer Area***

### **Previous Investigations**

As part of the RI, Weston collected a sample of “sediment” from the surface of a concrete pad in a former transformer area. This sample was analyzed for PCBs. A concrete chip sample of the transformer pad and samples of surrounding surface soils were collected for laboratory analysis as part of the Supplemental RI. These samples were also analyzed for PCBs.

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## **Results of Previous Investigations**

Attachment 1 includes a sample location map and Section A.7 of Attachment 1 includes data tables summarizing the results of the analyses of these transformer pad area samples. The results of the concrete chip sample indicated concentrations of PCBs greater than the NRDCSCC. PCBs were not detected in the surrounding surface soil samples.

## **Planned Activities**

As part of the interim response action, the concrete pad will be removed in its entirety and disposed off site. Sampling and analysis of the concrete pad will be conducted for preparation of a waste classification determination form to be submitted to the NJDEP Waste Classification Unit. Confirmation soil samples will be collected from the area beneath the pad following its removal.

## **2.4 DIAMOND SITE REMEDIAL INVESTIGATION SUMMARY**

### **2.4.1 Physical Setting**

The Diamond Site is approximately 27 acres in area. The Diamond Site is bounded by the Hackensack River to the east, Belleville Turnpike to the west, an elevated Amtrak railway line and associated embankment to the north, and the SCCC Site to the south. Figure 1-2 includes a Site map for the Diamond Site. With the exception of two structures, the site has been razed. During 1974, Dead Horse Creek, which ran from the southwest to northeast across the site and discharged into the Hackensack River, was filled. Filling activities were performed under the oversight of the NJDEP. Flow from the creek was diverted to a concrete storm drain installed along the southern property boundary, between the Diamond and SCCC sites.

### **2.4.2 Site History**

A detailed description of the Site operational history is provided in the RI Report<sup>15</sup> prepared by Brown and Caldwell dated April 2001. In summary, the facility engaged in the processing of imported chromite ore for the production of sodium bichromate, which was sold and used in the manufacture of chromium chemicals. Chemicals manufactured onsite included chrome-based leather tanning agents and chromic acid. Processing of chromite ore for the production of sodium bichromate continued until November 1971. Production of tanning agents and chromic acid at the site ceased in December 1976, and the majority of the structures on the Site were razed in 1978.

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<sup>15</sup> Brown and Caldwell, April 2001, Remedial Investigation Report Site 113 (Diamond Site).

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### **2.4.3 Area of Concern Summary**

Pursuant to a 1990 ACO, an RI has been conducted at the Diamond Site to address the extent of chromium in the soils, groundwater, air, surface water, and sediment and to assess the potential impacts on human health and the environment. The investigation activities were initiated in 1992. The results of the RI were presented in the *Remedial Investigation Report Site 113 (Diamond Site)*, Brown and Caldwell, April 2001. The NJDEP comments regarding the Remedial Investigation Report for the Diamond site were transmitted to Tierra in a letter dated December 23, 2005. The NJDEP letter requires Tierra to conduct additional remedial investigation activities prior to the implementation of the final remedial actions at the Diamond Shamrock site. In response to this letter, Tierra submitted a response to comment document on February 24, 2006 and a Supplemental Remedial Investigation Work Plan to the NJDEP on March 24, 2006.

As discussed previously, various investigations have been performed at the Diamond Site. Analytical data acquired during these investigations is provided in Attachment 1. A site map showing sample locations is also provided in Attachment 1 for reference. The following sections summarize the site conditions by individual Areas of Concern and reference the specific section within Attachment 1 containing data relative to that Area of Concern. For the Diamond Site, the Areas of Concern are defined as follows:

- Area of Concern 1 – Soil;
- Area of Concern 2 – Shallow Fill Unit Groundwater;
- Area of Concern 3 – Deeper Sand Unit Groundwater;
- Area of Concern 4 – Hackensack River Surface Water; and,
- Area of Concern 5 – Hackensack River Sediments.

The following information regarding the nature and extent of constituents of interest in environmental media at the Diamond Site was obtained from the 2001 Remedial Investigation Report.

#### **2.4.3.1 Diamond Site Area of Concern 1 – Soil**

##### **Previous Investigations**

On May 13, 1985, E.C. Jordan Co. collected six surficial soil samples for Dioxin analysis at the request of NJDEP. No Dioxin was detected in any of the samples and it was therefore decided that no further investigation was warranted.

During the RI, a total of 52 surface soil samples were collected for analysis. Surface soil samples were analyzed for Cr, Cr(VI), and TAL metals. Thirty-seven (37) soil borings were completed during the RI to characterize subsurface soil. A total of 125 soil samples were collected from these borings for analysis of Cr, Cr(VI) and TAL metals. In addition, 37 samples

(one from each boring) were analyzed for VOCs, SVOCs, Total Petroleum Hydrocarbons (TPH), and pesticides/PCBs.

### **Results of Previous Investigations**

According to the RI Report, the majority of site soils contain total and hexavalent chromium as a result of the COPR soil filling that occurred on this site. These detections are limited to soils above the meadow mat. Selected soil samples were also analyzed for VOCs, SVOCs, TPH, and Polychlorinated Biphenyls (PCBs).

VOC concentrations were less than the NRDCSCC in all samples. High molecular weight PAH compounds were detected at concentrations greater than the NRDCSCC in some samples; however, no discernable spatial relationships regarding the distribution of these compounds in soil are evident. Concentrations of PCBs greater than the NRDCSCC were measured in only one of 37 samples analyzed.

Attachment 1 includes a sample location map and Section B.1 of Attachment 1 includes data tables summarizing the results of the analyses of the Diamond Site soils.

### **Planned Activities**

Supplemental investigation of surface and subsurface soil was proposed by Tierra in the March 2006 SRI Workplan and will be conducted during implementation of the final RI to be completed at a later date. The majority of the Diamond Site is currently covered by existing IRMs. Installation of additional surface cover materials will be completed in portions of the Diamond Site and upgrading of the stormwater management system will be conducted in conjunction with surface cover installation (Section 3.6). Subsurface impacts will be addressed by the barrier wall and hydraulic control systems.

#### ***2.4.3.2 Diamond Site Area of Concern 2 – Shallow Fill Unit Groundwater***

### **Previous Investigations**

Eighteen (18) monitoring wells (nine well couples with each couple consisting of one well in the shallow fill unit and one well in the deeper sand unit) were installed at the Diamond Site during the RI. All wells were sampled on two occasions (June 1993 and May/June 1996). Samples from each well were analyzed for hexavalent chromium, TAL metals, VOCs, SVOCs, pesticides, and TPH.

### **Results of Previous Investigations**

Hexavalent chromium is pervasive in the shallow fill unit groundwater. However, it appears that the extent of hexavalent chromium does not extend beyond the limits of the COPR soil fill.



Attachment 1 includes a sample location map and Section B.2 of Attachment 1 includes data tables summarizing the results of the analyses of the shallow fill unit groundwater.

### **Planned Activities**

Supplemental investigation of shallow groundwater was proposed by Tierra in the March 2006 SRI Workplan and will be completed at a later date as part of the final RI. The proposed IRA for groundwater consists of installation of a fully enclosing physical barrier wall system to mitigate transport of constituents to the Hackensack River and adjacent properties (Section 3.1) and installation of a system to maintain hydraulic control through groundwater extraction and treatment (Section 3.2).

#### ***2.4.3.3 Diamond Site Area of Concern 3 – Deeper Sand Unit Groundwater***

### **Previous Investigations**

The deeper sand unit groundwater was investigated in concert with the shallow fill unit groundwater as discussed in the preceding section.

### **Results of Previous Investigations**

Hexavalent chromium is generally not present in detectable concentrations in the deeper sand unit. The one exception is that hexavalent chromium was reported present in monitoring well 113-W-104(D), located at the northeastern corner of the Site, at a concentration of 3 mg/L during the 1996 sampling event. Hexavalent chromium was not detected in the sample collected from this well in 1993. It is possible that the reported detection of hexavalent chromium in monitoring well 113-W-104(D) is the result of a sampling or laboratory error. This seems likely because the well yielded non-detected results 3 years before and because hexavalent chromium was reported as not detected in the adjacent shallow well for the 1996 sampling event. For the 1993 sampling event, hexavalent chromium was detected in the shallow well but not in the deeper sand unit well, which is consistent with findings across the remainder of the Site. Thus, a possibility exists that the shallow and deeper unit samples from the 1996 sampling event were transposed in the field or in the laboratory.

The absence of hexavalent chromium in the deeper sand unit is attributable to the reduction of hexavalent chromium to trivalent chromium as the groundwater moves through the meadow mat, which has been shown to exhibit a strong reducing capacity. Total chromium concentrations in excess of the NJ Class II-A GWQS are widespread within groundwater in the deeper sand unit, which is consistent with the concept of hexavalent chromium reduction. The total chromium may be indicative of the presence of suspended solids in the historical samples.

Groundwater samples were also analyzed for VOCs, SVOCs and pesticides/PCBs. Some organic constituents were detected at concentrations greater than their respective Class II-A GWQS. The majority of the SVOC exceedances were reported in samples collected from the

deeper sand unit in the southern portion of the Site. Brown and Caldwell attributed the presence of these organic compounds in the groundwater to the DNAPL source on the adjacent SCCC Site. Attachment 1 includes a sample location map and Section B.2 of Attachment 1 includes data tables summarizing the results of the analyses of the deeper sand unit groundwater.

### **Planned Activities**

Supplemental investigation of groundwater in the deeper sand unit was proposed by Tierra in the March 2006 SRI Workplan and will be completed at a later date as part of the final RI. The proposed IRA for groundwater consists of installation of a fully enclosing physical barrier wall system to mitigate transport of constituents to the Hackensack River (Section 3.1) and installation of a system to maintain hydraulic control through groundwater extraction and treatment (Section 3.2).

#### ***2.4.3.4 Diamond Site Area of Concern 4 – Hackensack River Surface Water***

### **Previous Investigations**

Surface water samples were collected along five transects in the Hackensack River. Three surface water samples were collected from each transect. Surface water samples were analyzed for TAL metals and Cr(VI).

### **Results of Previous Investigations**

Hexavalent chromium was detected in several of the surface water samples collected from the Hackensack River. However, the measured concentrations are significantly less than the NJDEP Class SE-2 SWQC. Attachment 1 includes a sample location map and Section B.2 of Attachment 1 includes data tables summarizing the results of the surface water analyses.

### **Planned Activities**

No exceedances of the SWQC have been reported during the investigation of the Diamond Site. However, in the SRI Workplan, Tierra has proposed additional sampling and analysis of the surface water in the Hackensack River adjacent to the eastern boundary of the Site.

Through the construction of the fully enclosing physical barrier wall system (Section 3.1), installation of a groundwater extraction and treatment system to exercise hydraulic control (Section 3.2) and construction of the stormwater management system upgrades (Section 3.6), the potential for future impact to the river via discharges to surface water will be eliminated.

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#### **2.4.3.5 Diamond Site Area of Concern 5 – Hackensack River Sediment**

##### **Previous Investigations**

Sediment samples were collected along five transects in the Hackensack River along the Diamond Site shoreline. Except for the northern-most transect, three sediment samples were collected from each transect. At the northern-most transect, only the sediment sample nearest to the shore could be collected as a result of the lack of recoverable sediments, likely a result of swift currents beneath the nearby railroad bridge. Sediment samples were analyzed for VOCs, SVOCs, pesticides, PCBs, and TAL metals.

##### **Results of Previous Investigations**

Sediment samples collected adjacent to the Site and along the shore of the Hackensack River exhibit concentrations of total chromium that are greater than the ER-M with no discernable concentration trends with respect to sample locations. Two sediment samples collected slightly downstream of the Site and adjacent to the SCCC Site contained chlorobenzene. Attachment 1 includes a sample location map and Section B.1 of Attachment 1 includes data tables summarizing the results of the analyses of the Hackensack River sediment.

##### **Planned Activities**

Sufficient characterization data exist to permit the removal of the near-shore sediments. Near-shore sediments in the Hackensack River will be removed via excavation and will be managed in accordance with the materials management decision flowchart (Figure 1-3). Additional sampling and analysis will be performed during the IRAW implementation to support waste classification including preparation of a waste classification determination form to be submitted to the NJDEP Waste Classification Unit. Conditioning requirements for river sediments will be evaluated, as necessary, during the course of the IRAW implementation.

## **2.5 EXISTING INTERIM REMEDIAL MEASURES**

Existing interim measures completed at the SCCC and Diamond Sites are described in the following subsections.

### **2.5.1 SCCC Site**

A series of IRMs were completed by SCCC in the early 1990s. The IRMs were completed in accordance with a NJDEP-approved Workplan and included the following tasks:

- Installation of security fencing surrounding the former production area and lagoons;
- Addition of soil to the lagoon berm to increase its height and freeboard;

- Placement of geotextile and rip rap along the Hackensack River shoreline in the vicinity of the lagoon;
- Removal of the contents of five aboveground storage tanks; and,
- Repackaging of the asbestos-containing material removed from the former distillation building.

To mitigate potential risk of human exposure to hexavalent chromium at the property, IRMs were implemented in February 1991 in the western and central sections of the SCCC Site. The COPR soil IRMs implemented at the site were as follows:

- Asphalt pavement overlay on traffic areas with existing asphalt;
- Asphalt paving with geotextile fabric over existing soils, overlain by 4 inches of dense graded aggregate, overlain by 4 inches of asphalt of all remaining traffic areas;
- Construction of an interim surface cover in non-traffic areas west of the railroad right-of-way with geotextile/geomembrane liner overlain with 4 inches of dense graded aggregate; and,
- Dust fence barrier along the railroad right-of-way and north fence line to isolate the impacted surface soil in the former process area.

## **2.5.2 Diamond Site**

In accordance with the Diamond Site ACO, an Interim Remedial Measures Work Plan was prepared, *inter alia*, for the Diamond Site. The stated objectives of the IRM were to: 1) prevent the discharge of chromium and its compounds by way of all routes of potential human exposure; and, 2) to allow the present use of the site to continue to the greatest extent possible<sup>16</sup>. Consistent with that work plan, the following IRMs were implemented on the Diamond Site to address the chromium associated with the COPR soil:

- Installation of geotextile fabric/geomembrane liner over existing soils, overlain by up to four inches of dense graded aggregate along the eastern edge of the property and in two central areas of the Diamond Site, as well as along the Amtrak embankment in the northeast corner of the Site. A similar approach was used along the bank of the Hackensack River, where the fabric/liner was overlain by riprap;
- Placement of geotextile fabric/geomembrane liner over existing soils, overlain by up to four inches of dense graded aggregate, overlain by four inches of asphalt on the majority of the eastern portion of the Site; and,

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<sup>16</sup> Brown and Caldwell, April 2001, Remedial Investigation Report Site 113 (Diamond Site).

- Covering of existing pavement with two inches of asphalt in areas along the existing roadway and within a portion of the site around the former production buildings.

## **2.6 BASELINE ECOLOGICAL EVALUATIONS**

Baseline Ecological Evaluations (BEEs) have been completed separately for the SCCC Site and the Diamond Site. The ecological evaluations were performed in accordance with N.J.A.C. 7:26E-3.11. The results of these evaluations are summarized in the following subsections. Note that additional and separate ecological evaluations will be completed during anticipated remedial investigation efforts for both sites and will be considered during development of the final remedy for the Sites.

### **2.6.1 SCCC Site Baseline Ecological Evaluation**

A BEE for the SCCC site was completed by Enviro-Sciences, Inc. (ESI). The results of the BEE are presented in the *Remedial Action Workplan, Standard Chlorine Chemical Company, Inc., Kearny, New Jersey* (ESI, 2000). To date, the NJDEP has not commented on the BEE. The NJDEP indicated in its April 11, 2007 NOD that a review of the BEE had been completed and that specific technical review comments will be forwarded to SCC under separate cover. The Group will provide a replacement BEE to the NJDEP as part of the future RI Reporting for the SCCC Site.

### **2.6.2 Diamond Site Baseline Ecological Evaluation**

The results of a BEE for the Diamond Site are presented in the April 2001 RI Report. The constituents of ecological concern were identified as follows:

Arsenic	Dibenzo(a,h)anthracene	1,3-Dichlorobenzene
Benzene	Ethylbenzene	1,4-Dichlorobenzene
Benzo(a)anthracene	Naphthalene	4,4-DDD
Benzo(a)pyrene	Nickel	4,4-DDT
Benzo(k)fluoranthene	Toluene	4,4-DDE
Chlorobenzene	Xylenes	
Chromium	1,2-Dichlorobenzene	

An ecological site inspection was conducted on May 1, 2000 to identify environmentally sensitive areas on or adjacent to the Site. The only potential environmentally sensitive area identified was the Site groundwater. Based on the site inspection, the Hackensack River was identified as the only potential environmentally sensitive area adjacent to the Site. In addition, the NJDEP Geographic Information System was accessed to determine if any other environmentally sensitive areas were mapped at this location. These results confirmed that the river is the only potential environmentally sensitive area adjacent to the Site.

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Because the extent of impact to groundwater at the Site is limited to areas where COPR soil has been placed, one conclusion reached as a result of the BEE was that no further ecological investigation relative to groundwater was warranted.

An ecological assessment of the potential effects of chromium sites in general was conducted during 1991 and 1992. The assessment focused on a large wetlands area north of Site 51 (Janatex) that was surrounded on three sides by chromium sites, and included a section of the Hackensack River adjacent to Site 131 (Hackensack River Access Road). The findings of the summary report<sup>17</sup> were approved by the NJDEP. The results of that assessment are summarized as follows:

- Chromium concentrations in surface water are less than New Jersey and federal water quality criteria;
- The reducing conditions and high organic carbon content of the sediments essentially preclude the formation of hexavalent chromium, and limits the bioavailability of chromium to indigenous living organisms in the food chain;
- No ecologically or biologically significant effects were observed which could be attributed to COPR soil;
- These findings are consistent with existing knowledge and literature regarding the general environmental fate of chromium, the relatively low toxicity of trivalent chromium, and the low potential of chromium to bioaccumulate; and,
- As a result of the extent and proximity of COPR soil to the river, these results are representative of “worst-case” conditions with respect to the potential for chromium to adversely affect the ecology.

Based on the results of this ecological investigation, it is concluded that there has been no ecological impact from the Diamond Site to the Hackensack River. As indicated previously, additional sediment investigation in the river will be conducted pursuant to the Hackensack River Study Area (HRSA) RI Workplan. Tierra has also performed toxicity testing for sediments in the vicinity of the Diamond Site. The toxicity tests showed that concentrations of total Cr and Cr(VI) as high as 1,310 and 19 mg/kg, respectively were not toxic to two sensitive and representative benthic macroinvertebrate species. The results of this study were provided to the NJDEP with the response to comment document submitted on February 24, 2006. The study also demonstrated that Cr in the sediments had limited bioavailability because most of it was in the form of essentially insoluble Cr(III) based on the chemical phases identified by electron microprobe analysis (i.e., chromite and iron oxide).

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<sup>17</sup> Eckenfelder, Inc. 1992, *Final Report and Assessment of the Potential For Impacts Due to Chromite Ore Processing Residue Deposition in the Hackensack Meadowlands*.

Additional ecological evaluation for the Diamond Site will be performed based on the results of these investigations at the appropriate time as part of the RI. All ecological risk evaluations will conform to EPA's *Ecological Risk Assessment Guidance for Superfund* (ERAGS). The ERAGS process requires that a Problem Formulation Step follow the screening-level risk assessment. The Problem Formulation Step, which includes the development of a Conceptual Site Model and identification of relevant assessment endpoints, concludes with a Scientific Management Decision Point, at which time concurrence from all Stakeholders is required.

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## **3.0 IRA COMPONENTS AND DESIGN REQUIREMENTS**

This section provides a description of the IRA components and associated design data necessary to implement the IRA at the SCCC and Diamond Sites. Descriptions of each of the major components, the design requirements for each, and the planned design activities are discussed. The plan locations of the major IRA components, including proposed AOC Policy consolidation areas (contingent upon material management decision outcomes – Figure 1-3) are shown on Figure 3-1.

### **3.1 PHYSICAL BARRIER WALL SYSTEM**

The barrier wall system consists of a fully enclosing slurry wall installed around the entire perimeter of the combined Sites. The slurry wall will be keyed into the varved clay unit. The slurry wall will serve as a barrier to migration of impacted groundwater and DNAPL to the Hackensack River surface water and sediments and offsite properties. A steel sheet pile wall will be installed outboard of the slurry wall along the SCCC Site and Diamond Site frontage along the Hackensack River to serve as a structural element. The steel sheet pile wall will also be keyed into the varved clay. The sheet pile wall is a structural component (i.e., retaining wall) which is not necessary for the remaining inland Site perimeter. The performance of the response action will be evaluated through a post-construction monitoring program. The monitoring program will consist of water level measurements to ensure adequate groundwater containment as further discussed in Section 3.2. The monitoring program will determine head differentials across the slurry wall and between the fill and deep sand units. Results of the post-construction monitoring will be reported to the NJDEP.

#### **Description:**

The proposed fully enclosing physical barrier wall system will be constructed on the Diamond and SCCC Sites as shown on Figure 3-1. Figure 3-2 presents barrier wall details. A description of the barrier wall system is provided below:

1. A slurry wall will be installed along the entire perimeter of the combined Sites (i.e., along the entire frontage of the Hackensack River with the SCCC Site and Diamond Site, along the northern property boundary of the Diamond Site, the western property boundary of the Diamond Site, the western property boundary of the SCCC Site, and the southern boundary of the SCCC site). The slurry wall will be keyed a minimum of three feet into the varved clay to fully contain the shallow fill and deeper sand units. The slurry wall will be constructed with a top elevation of 7 feet above mean sea level (ft-msl) to accommodate (i.e., exceed) the projected maximum post-construction groundwater elevation on the outboard side of the slurry wall. Working platforms will be constructed as necessary to accommodate slurry wall installation.



Waste classification will be conducted using soil samples obtained (and analyzed) during completion of test borings performed along the proposed barrier wall alignment. Excess soils generated during construction of the slurry wall will be managed in accordance with the materials management decision flowchart (Figure 1-3). Based upon the specification to key the slurry wall a minimum of three-feet into the varved clay unit, the depth to the base of the barrier will range from approximately 20 to 25 feet below ground surface.

2. A 1,200 linear foot (lf) structural component consisting of a steel sheet pile wall will be installed outboard of the slurry wall along the Hackensack River and connected to the existing 6000 lf steel sheet pile wall at the Seaboard Site. The sheet pile wall will be keyed at least three feet into the varved clay unit, and possibly deeper, if required to provide adequate lateral earth support. The steel sheet pile wall will be constructed with a minimum top elevation of 10 ft-msl. The plan location of the sheet pile wall will be selected to provide for the installation above the mean high water line of the Hackensack River (i.e., 3.1 ft msl). In addition, the steel sheet pile wall will include sealed joints.

Note that the actual location of the barrier wall system will be subject to permitting and access considerations. However, it is expected that the riverside slurry wall and sheet pile wall will be installed as near to the Hackensack River as possible, and, consistent with permit requirements, will be designed to contain impacted groundwater and DNAPL to the maximum extent practicable. It is further assumed that the perimeter slurry wall will be installed as close to the property line as possible given considerations regarding the existence of utility lines and areas of structural concern (e.g., the New Jersey Transit Authority rail line embankment).

### **Design Requirements:**

The proposed barrier wall system will mitigate the potential for migration of DNAPL and impacted groundwater to the Hackensack River surface water and sediments and prevent potential migration of constituents to other offsite areas located to the north, west, and south. The design standards for the proposed barrier wall system are:

- The slurry wall will be located to provide containment needed to achieve the remedial objectives;
- The slurry wall will be keyed a minimum of three feet into the low permeability varved clay unit; the steel sheet pile will be embedded deeper (if required) to provide adequate lateral earth support;
- The slurry wall will be constructed of materials that are chemically compatible with site constituents as verified by a standard mix design assessment;
- The steel sheet pile will be designed to be structurally sound, as dictated by proposed final site surface grades;

- The steel sheet pile wall structural design will address tidal fluctuations, the implications of major storm/flood events (e.g., rapid drawdown conditions) and the proposed excavation of near-shore sediments;
- The barrier wall alignments will be designed to comply with applicable regulatory/permit requirements (such as plan location relative to the mean high water line); and,
- The slurry wall will be designed to achieve a permeability requirement not greater than  $1 \times 10^{-7}$  cm/sec. An appropriate mix must be selected during the design phase.

### **Design Activities:**

Data acquisition activities to support the design of the barrier wall system are proposed in Section 4.1. Design deliverables will consist of detailed design drawings and technical specifications for construction and a Construction Quality Assurance Plan (CQAP). The following aspects of the proposed barrier wall system will be assessed in detail, to ensure that the proposed remedy will fully serve its intended function:

### ***Barrier Wall Materials***

The slurry wall excavation will be backfilled with a soil-bentonite mixture. Testing of existing soils (i.e., sands excavated in association with slurry wall construction) and bentonite will be completed to develop the appropriate slurry wall backfill mix. Existing Site DNAPL and groundwater data were reviewed to assess whether the soil-bentonite slurry is compatible with DNAPL and groundwater chemistry. This assessment suggests that the slurry wall backfill should be compatible with Site groundwater COIs. The steel sheet pile wall will be constructed using coated steel panels with sealable interlocking joints. The coated steel is compatible with Site groundwater and DNAPL constituents.

### ***Sheet Pile Interlock Sealing Methods***

The steel sheets will be driven as “welded pairs” with sealable interlocks. Joint sealant technology, including installation of water-swelling compounds and grouting, will be assessed for sealing the unwelded steel sheet pile interlocks, to provide compatibility with Site DNAPL and groundwater constituents.

### ***Sheet Pile Wall Structural Design***

The target depth of the steel sheet pile barrier wall will be selected to, at a minimum, “key” the wall three feet into the low permeability varved clay unit. This target wall depth may be increased, based upon slope stability analyses and detailed design calculations, to accommodate additional structural design requirements as described below.

The wall depth and steel sheet pile cross section/modulus will be designed to provide adequate structural support, and to accommodate lateral earth pressure resulting from backfill placement behind the wall. The design parameters to be determined will include:

- Wall embedment depth;
- Sheet pile cross section/modulus; and,
- Anchor tie-back configuration (if required).

These detailed structural calculations will utilize Site-specific geotechnical data to be obtained during the aforementioned design data acquisition activities. In particular, the relatively low subgrade support/shear strength of the meadow mat layer will be assessed in detail. Furthermore, vibration analysis is likely to be necessary for the northernmost portion of the steel sheet pile wall. Shoring of the railroad embankment or other comparable methods of protecting the railroad right-of-way may be necessary.

### ***Wall Height***

The height of the slurry wall will be the minimum necessary to prevent overtopping of the wall by groundwater from the exterior of the wall. Based on the groundwater modeling results, the top elevation of the slurry wall will be at a minimum of 7 ft-msl. It is likely that working platforms (compacted imported earthen fill) will be necessary around the perimeter of the Sites to accommodate installation of the slurry wall to a consistent final height. The sheet pile wall will extend to an elevation of 10 ft-msl which corresponds to the 100-year flood elevation.

## **3.2 HYDRAULIC CONTROL SYSTEM**

The hydraulic control system will consist of the installation of multiple fill unit groundwater extraction wells and shallow fill and deep sand unit DNAPL recovery wells. A groundwater treatment plant will be constructed to treat the extracted groundwater. Groundwater extraction will be conducted to 1) control groundwater mounding within the fully-enclosing barrier wall system; 2) maintain a water table elevation that will preclude the potential upward migration of hexavalent chromium; 3) provide for an inward hydraulic gradient; and, 4) provide for an upward or neutral hydraulic gradient between the deep sand unit and the fill unit.

Twenty-seven (27) fill unit extraction wells and eight (8) deep sand recovery wells will be installed. Five of the fill unit wells will be DNAPL recovery wells. The deep sand recovery wells will be installed to recover DNAPL, as subsequently discussed.

Based on groundwater modeling completed to date, it is anticipated that pumping of the fill unit wells at 0.5 gallons per minute (gpm) or less each and pumping of the deep sand wells at 0.5 gpm each will be sufficient to exercise the requisite hydraulic control. The wells will be equipped with level switches to maintain the groundwater levels at the desired elevations.

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A groundwater treatment plant capable of treating 30 gpm will be constructed. The groundwater treatment plant will consist of a primary DNAPL phase separator, a primary hexavalent chromium chemical reduction unit, and solids, metals, and organics removal polishing units. Treated water will be discharged to the Hackensack River under an NJPDES General Permit.

**Description:**

Hydraulic control will be implemented to prevent a rise of the water table within the barrier wall enclosure. Numerical groundwater modeling (Appendix A) has demonstrated that an average total combined pumping rate of approximately 8 gpm will be sufficient to maintain the water table at its existing elevations. A total of 35 recovery wells screened in the shallow fill and the deep sand will be used to maintain hydraulic control. Based on evaluation of existing groundwater and DNAPL data, the planned groundwater treatment system will consist of the following:

- Residual DNAPL separation;
- pH control and hexavalent chromium reduction;
- pH control and metals precipitation/flocculation;
- Solids dewatering and management; and,
- Dissolved organics removal via carbon adsorption.

System design and construction will be based on anticipated influent groundwater chemistry, expected discharge limits established pursuant to the NJPDES permitting process, field verification activities, and the required pumping rate from each dewatering and DNAPL recovery area. A proposed layout of the groundwater recovery system based on the groundwater modeling results included as Appendix A (including the DNAPL recovery wells discussed in Section 3.3) is provided as Figure 3-3. A process flow diagram for the groundwater treatment plant is provided as 3-4. Details for a typical shallow groundwater recovery well and the DNAPL recovery wells (shallow and deep) are presented on Figure 3-5.

Upon the completion of the barrier wall installation and installation and initial start-up of the hydraulic control system, the effectiveness of these components of the IRA will be assessed via a hydraulic control monitoring program. Water levels will be measured on a quarterly basis for a period of two years to demonstrate containment. Water levels will be monitored in the wells/piezometers depicted on Figure 3-3 which includes a number of proposed new piezometers.

**Design Requirements:**

The hydraulic control system and treatment plant must maintain hydraulic control, comply with the final NJPDES permit requirements, and be constructed in accordance with applicable codes and standards. Specific design requirements for the hydraulic control system consist of the following:

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- Groundwater COI concentrations will be identified through the collection and analysis of additional groundwater samples to support identification of appropriate treatment approaches;
  - General groundwater quality data will be identified through the collection and analysis of additional groundwater samples to identify potential solids settling rates;
  - Bench-scale jar testing will be required to identify appropriate reagents and dosing rates for the treatment system;
  - Discharge limits will be developed through consultation with the NJDEP and will support identification of appropriate treatment technologies and the sizing of equipment;
  - The optimum pumping rate for hydraulic control will be determined through refined modeling that considers the proposed IRA cap configuration and potential infiltration rates. The pumping rates (in part) will be used to develop piping, pump, and equipment specifications; and,
  - Pumping well locations will be used to develop requisite piping, pump, and utility requirements.

In addition to the preceding, groundwater recovery and treatment design will incorporate the design information generated for the DNAPL recovery system discussed in Section 3.3.

**Design Activities:**

Current groundwater quality data will be reviewed and discharge limits will be established through consultation with the NJDEP as documented in an NJPDES permit application to support the groundwater pumping and treatment alternative. The deliverables will consist of detailed design drawings and technical specifications for construction, a Construction Quality Assurance Plan (CQAP), and an NJPDES permit application. The following aspects of the proposed groundwater recovery and treatment system will be assessed in detail:

***Treatment Plant Unit Operations***

Required process units, pumps, piping, and instrumentation will be selected based on expected influent and effluent concentrations and the planned pumping rate. Process unit coatings and necessary materials will be chemically compatible with the Site-related constituents and the treatment reagents to be used. The units will be oversized to accommodate additional flow from hydraulic control wells or DNAPL recovery location, if required. The process components will have a maximum flow of approximately 30 gpm. Removal calculations have been completed to determine requisite treatment techniques. Solids handling will be incorporated to accommodate solids settling, dewatering, and disposal. Appropriate process control instrumentation will be identified and installed. Process and Instrumentation Diagrams will be prepared.

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### ***Treatment Plant Location***

Equipment sizing and layout, existing site physical features, the availability of utilities, the location of the recovery wells, the proximity to the receiving surface water body, and stream encroachment considerations will be considered to identify an appropriate treatment plant location. The treatment plant will be located to minimize potential interference with ongoing site maintenance activities, to accommodate ready access for maintenance (e.g., carbon change out), and to minimize piping runs.

### ***Permit Applications***

An NJPDES permit will be necessary for this IRA element. Permitting requirements are identified in Section 5.0 of this IRAW.

### ***Discharge Monitoring***

Monitoring of effluent concentrations will be conducted as required by the permit. Discharge monitoring and reporting requirements and the outfall location will be identified during the permitting process. An appropriate sample location downstream of the last treatment unit will be identified. Internal system monitoring sample ports will also be incorporated to facilitate evaluations of individual processes (e.g., between carbon units) on an as-needed basis.

### ***Piping and Conduit***

Hydraulic calculations will be performed, based upon anticipated groundwater extraction rates, to determine the size of the pipes to convey the extracted groundwater to the treatment plant. Conveyance piping will consist of high density polyethylene, which is chemically compatible with the groundwater constituents. Conduit will be installed to provide power to the wellheads.

A piping layout from the recovery wells to the treatment plant is shown on Figure 3-3. Piping and conduit will be installed to avoid existing structures. Piping will be installed at a depth designed to limit frost effects and will be heat-traced and insulated where above ground. Various piping materials (e.g., steel, high density polyethylene, polyvinyl chloride) will be used within the treatment plant contingent upon their location within the treatment train.

### ***Pumps***

The groundwater extraction pumps will be sized based on the anticipated flow rate and required discharge head. Submersible pumps compatible with the Site constituents will be installed. Transfer pumps and precipitate material pumps will be sized for the flow rates and materials to be generated.

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### ***Power Distribution and System Controls***

Power supply and distribution will be adequate to accommodate well pumps and process system requirements. Power will be supplied in 480 volts single phase and distributed at the voltage and amperage requirements for the requirements of each motor, process equipment, instrumentation, and utility. The groundwater recovery and DNAPL recovery wells will incorporate conductivity switches to prevent pumping the extraction wells dry and to maintain the water levels at the desired elevations.

### ***Materials Management***

Treatment plant material management procedures will be developed in detail through the permitting process. In general, RCRA characteristic and TCLP testing will be completed to determine the RCRA waste classification and off-site treatment/disposal options. It is planned that any DNAPL generated via separation will be conveyed to DNAPL storage containers associated with the DNAPL recovery wells and will ultimately be recycled or incinerated off site. It is expected that metals removal-related solids will be landfilled offsite and that the activated carbon will be thermally regenerated. Cuttings from well drilling will be consolidated onsite in an AOC or disposed off site per the materials management decision flowchart (Figure 1-3) and in accordance with all applicable rules and regulations.

## **3.3 DNAPL RECOVERY SYSTEM**

This aspect of the planned IRA consists of installation of an active system to recover DNAPL from the shallow fill unit and the deeper sand unit at the SCCC Site. Although DNAPL recovery is not necessarily required in connection with the installation of the barrier wall containment system, the Group acknowledges that a recovery system will be necessary to accomplish the long-term objective of DNAPL removal to the maximum extent practicable. The Group is in agreement with the NJDEP that sufficient information currently exists for design and construction of a DNAPL recovery system. Consequently, the Group proposes to construct the DNAPL recovery system in conjunction with the IRA. The DNAPL recovery system will also be a component of overall hydraulic control for the site. Recovered DNAPL will be recycled or treated/disposed off site, and groundwater recovered during the pumping operations will be treated in the onsite treatment plant and discharged to the Hackensack River pursuant to an NJPDES permit.

### **Description:**

Active DNAPL recovery will be implemented in both the shallow fill unit and deeper sand unit on the SCCC Site. The proposed DNAPL recovery system will consist of a series of collection units that combine features of a well and a sump from which groundwater will be extracted to enhance the recovery of DNAPL.

To optimize the DNAPL recovery, the collection units will be installed near DNAPL “entry zones”, such as the lagoon and Building 4 areas and low-lying areas in the upper surface of basal confining units where the DNAPL has pooled. The design of the collection units will allow for effective in-well physical separation of groundwater and DNAPL. DNAPL that enters the well will separate by gravity and will accumulate in a solid-walled sump at the base of the well. Groundwater extracted in conjunction with DNAPL recovery will be treated on site and discharged to the Hackensack River.

The recovered DNAPL will be recycled or disposed off site as appropriate. DNAPL recovery well locations are depicted on the hydraulic control plan view (Figure 3-3). Details regarding the planned construction of the DNAPL recovery wells are depicted on Figure 3-5.

### **Design Requirements:**

Design requirements for the DNAPL recovery system are as follows:

- The selection of DNAPL recovery locations considered the historical process area locations, RI data relative to DNAPL occurrence, and confining unit configurations;
- The DNAPL collection well screens and filter packs and associated recovery system components must be designed to be compatible with the DNAPL constituents and to optimize the in-well physical separation of groundwater and DNAPL; and,
- The collection units should be designed to provide sufficient storage capacity to facilitate periodic removal of DNAPL from the unit.

### **Design Activities:**

The deliverables will consist of detailed design drawings and technical specifications for construction and a Construction Quality Assurance Plan (CQAP). The following aspects of the proposed DNAPL recovery system will be assessed in detail, to ensure that the proposed remedy will fully serve its intended function:

### ***DNAPL Recovery Locations***

DNAPL distribution data and geologic information have been reviewed in detail to determine the optimum locations to conduct DNAPL recovery. Recovery areas consist of DNAPL entry zones, topographically low areas in the upper surface of the confining units that may be indicative of potential areas of “pooled” DNAPL, and existing monitoring wells in which a significant thickness of DNAPL has accumulated.



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### ***DNAPL Recovery Well Construction***

Considerations for the design of the DNAPL recovery components include sizing of the recovery well and sump diameters and screen slot size selection to promote the effective in-situ physical separation of DNAPL and groundwater. Filter pack sizing and grading specifications will be developed to prevent sediment accumulation within the wells. The screen slot size and sump diameter will be selected to promote physical separation of groundwater and DNAPL within the collection unit. Construction materials will be evaluated to ensure that they are chemically compatible with DNAPL constituents. Sump length and diameter will be selected to provide sufficient storage capacity to optimize operations and maintenance resources.

### ***Piping***

Hydraulic calculations will be performed, based upon anticipated groundwater extraction rates, to determine the required size of the pipes to convey the extracted groundwater to the treatment plant. Materials will be evaluated to verify that they are chemically compatible with the groundwater constituents.

### ***Pumps***

The groundwater extraction pumps will be sized based on the anticipated flow rate and required discharge head for each sump. Low-power submersible pumps compatible with the Site constituents will be specified.

### ***Power Distribution and System Controls***

Power distribution requirements will be addressed in the design. The design will incorporate system controls to prevent pumping the extraction well dry, accumulation of DNAPL above the rim of the sump, and to maintain the water levels at the desired elevations.

## **3.4 LAGOON DEWATERING AND BACKFILLING**

The planned IRA for the SCCC lagoons has been developed based on the consideration of multiple objectives, as follows:

- Attainment of the Site Remedial Action Objectives as described in Section 1.2 of this IRAW;
- Consideration of NJDEP comments regarding a readily implementable alternative for the lagoons;
- Consideration of EPA comments regarding consolidation of materials in Areas of Contamination; and,

- Identification of a readily implementable remedy that could accommodate further characterization and completion of a different final remedy.

The following specific requirements were considered to develop an appropriate interim response for the lagoons:

- The planned IRA should eliminate the potential for subsurface discharge of constituents to the Hackensack River;
- The planned IRA should remove DNAPL to the extent practicable as a source control measure and should eliminate the potential for direct contact with constituents;
- The planned IRA should eliminate the potential for overland runoff of constituents to the Hackensack River;
- The planned IRA must be a remedy that can be “supported by available information and can be implemented”;
- The planned IRA cannot be “contingent upon the results of pre-design investigations and treatability studies that may or may not support and/or allow for implementation”;
- The planned IRA should ensure “that the locations for consolidation contain similar contaminants and concentrations as the materials that are being consolidated”; and,
- The planned IRA should allow for flexibility during the development of a final remedy such that alternative remedies may ultimately be selected for the lagoons.

Note that several alternative options were considered for the lagoons and were found to be inappropriate based on consideration of compliance with the foregoing requirements. A summary of the alternatives that were evaluated and have been excluded from consideration, and the rationale for their exclusion, is as follows:

*Onsite Consolidation in an Alternate Location Under an Interim Surface Cover*

This alternative was evaluated because the NJDEP had mentioned it as a potentially applicable approach in previous discussions with Group representatives. This potential option was excluded from consideration in view of potential short-term risks associated with exposure to the material during relocation. In addition, this alternative provides no additional benefit in terms of protectiveness because the fully-enclosing perimeter barrier wall will isolate the lagoon contents from potential off-site receptors. This alternative is also not implementable based on the EPA requirement that locations for consolidation should contain similar contaminants and concentrations as the materials that are being consolidated. No such potential consolidation areas exist on the SCCC Site.

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*Excavation and Offsite Transportation and Disposal*

This potential option was excluded from consideration as an interim response based on the absence of waste classification data to determine the nature of the lagoon solids and hence potential disposal options. This alternative cannot be “supported by available information”. Viable offsite disposal facilities cannot be identified at the current time. However, the data needed to evaluate this option as a final remedy will be obtained as described in Section 4.4. Preliminary inquiries into the viability of the off-site disposal of this material indicates that even when the additional information is available, it will be very difficult to find facilities that are legally able and willing to accept the material for treatment and/or disposal.

*In-situ Solidification of the Lagoon Solids*

This potential option was excluded from consideration as an interim response based on the absence of treatability study data that demonstrates the effectiveness of a potential solidification remedy. This alternative cannot be “supported by available information”. However, treatability studies will be conducted to assess solidification as part of the planned RI.

Based on the requirements previously outlined, dewatering, backfilling, and installation of an interim surface cover are planned as the IRA for the lagoons. This alternative, in concert with other components of the planned IRA, satisfies all of the foregoing requirements. Specifically, this alternative, combined with other IRA components will achieve the following:

- The planned IRA will eliminate the potential for subsurface discharge of constituents to the Hackensack River via the installation of the fully enclosing barrier wall and installation of the groundwater extraction and treatment system. Furthermore, dewatering of the lagoons will serve to reduce the potential for leachate generation and hence will mitigate the potential for ongoing subsurface impacts.
- The planned IRA will remove DNAPL to the extent practicable via the installation of DNAPL recovery wells, many of which will be located in the immediate vicinity of the lagoons. The planned IRA for the lagoons will also eliminate the potential for direct contact as a result of the installation of an interim surface cover.
- The planned IRA will eliminate the potential for overland runoff of constituents to the Hackensack River. Installation of the barrier wall system will limit flooding of the Site. Installation of the interim cover will also serve to mitigate the potential for offsite migration of constituents via overland runoff.
- The planned IRA can be accomplished using existing site data and requires the use of readily implementable technologies that can be accomplished in a timely manner with readily available equipment.

- The planned IRA does not require the collection of additional investigative data to support implementation. Furthermore, it does not require the completion of any treatability studies to determine if it is technically viable.
- The planned IRA does not create a potential short-term risk due to the potential for exposure to the material during construction as would result from the relocation of the lagoon solids to other areas of the site. Contingent upon material management decisions as outlined on Figure 1-3, the lagoons may be an appropriate consolidation location for river sediments and ditch soft soils given that these media contain similar constituents at concentrations lower than those that currently exist in the lagoons.
- The planned IRA includes of the installation of backfill materials that will be vertically segregated from the lagoon solids. Vertical segregation of the lagoon solids and the backfill materials will accommodate implementation of an alternate option as part of the final remedy at a later date.

As indicated, it is planned that the lagoons will be dewatered and capped with an interim surface cover to eliminate potential direct contact exposure and to control the potential for overland runoff. Other IRA components will address other objectives such as isolation from the river and source removal. Dewatering of the lagoon will be completed as the first phase of the lagoon preparation. Surface water from the lagoon will be treated in temporary treatment equipment mobilized to the Site. Given the variability in the water volume observed in the lagoons as a result of seasonal effects, this activity will likely be completed in the dry summer months. Upon completion of dewatering, the lagoon will be backfilled to meet the surrounding grade using successive lifts of either clean borrow material, or excavated river sediment. Geogrids will be used as necessary to provide tensile strength in areas of poor subgrade support, although Site inspections have shown that only a few portions of the lagoon contain soft materials. Samples of the lagoon contents will be obtained once dewatering is completed to support waste classification.

**Description:**

The lagoon contents (approximately 7,300 cubic yards) at the SCCC Site will be capped in place. The cap will be installed as an IRA while additional potential final remedial alternatives are evaluated for the lagoon contents. Potential alternatives for the final remedy consist of the following: 1) final capping (which could consist of the interim cap); 2) solidification and capping; and, 3) excavation and offsite treatment and/or disposal. As part of future RI activities, the Group will conduct a solidification treatability study and utilize the NJDEP waste classification determination to identify disposal facilities that are able and willing to accept dioxin-impacted materials for treatment/disposal.

Dewatering of the lagoon will be necessary prior to implementation of backfilling and capping. Upon completion of dewatering, the lagoon contents will be covered via backfilling with clean borrow material or Site target materials such as south ditch and/or Hackensack River near-shore

sediments, contingent upon material management decisions (Figure 1-3). Conditioned target material (near-shore river sediments and/or drainage ditch soft soils) or clean borrow material will be placed in successive lifts incorporating geogrids for tensile strength as necessary. It is planned that geogrid material will be placed as necessary on any soft areas in the existing solids and a lift of granular borrow material will be placed in these areas to establish a stable working surface. The geogrid will extend up the side walls of the lagoon and onto the surrounding soils and/or onto adjacent hard spots in the lagoon as appropriate. A geotextile fabric will then be placed as a demarcation layer between the lagoon solids and the backfill materials. Successive lifts will consist of either borrow or site target materials conditioned to take up moisture. Based on volume estimation, and contingent upon material management decision outcomes, it is planned that the south ditch soft soils will be placed in the west lagoon. These sediments will be covered with an additional geotextile, and the river sediments will be placed in the east lagoon and in the remaining air space in the west lagoon. Additional geogrid materials will be placed as necessary to provide tensile strength to stabilize the lagoon backfill. Proposed details regarding the lagoon backfilling are shown on Figure 3-6. Details regarding the interim surface cover, which will extend over the lagoon, are provided in Section 3.6.

#### **Design Requirements:**

Design requirements that must be satisfied to support dewatering, backfilling, and capping of the lagoons are as follows:

- Current lagoon surface water quality data will be necessary to support specification of a temporary treatment system;
- It is anticipated that the treated water will be discharged pursuant to a general NJPDES permit. The temporary treatment system will be designed to attain discharge standards that will be identified as part of the design process in consultation with NJDEP;
- The volume of water present in the lagoons may dictate sizing of treatment equipment contingent upon the time required for treatment of the surface water;
- The available freeboard in the lagoons must be determined to identify the volume of material required for backfilling; and,
- The compressibility of the meadow mat beneath the lagoons requires the collection of additional geotechnical data necessary for design of the lagoon cover system.

#### **Design Activities:**

The deliverables will consist of detailed design drawings and technical specifications for construction and a Construction Quality Assurance Plan (CQAP). The following aspects of the

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proposed lagoon dewatering and backfilling will be assessed in detail, to ensure that the proposed remedy will fully serve its intended function:

### ***Water Volume Estimation***

The quantity of surface water present in the lagoons may dictate sizing of treatment equipment contingent upon the temporal requirements for lagoon dewatering. Reasonable estimates of potential water content will be developed based on inspection of the lagoon during the course of the design phase, and via consideration of the potential impacts of seasonal rainfall events.

### ***Freeboard Evaluation***

Existing site topographic information and elevation data for the lagoon solids surfaces generated during historical investigation of the lagoons will be considered to identify the available freeboard in the lagoons. Coupled with development of the final grading plan for the lagoon area, this information will be used to specify the minimum fill requirements for the lagoons.

### ***Settlement Evaluation***

Geotechnical data will be necessary to determine potential settlement of the geologic units beneath the lagoon and surrounding area as a result of backfilling. Soil borings will be completed around the lagoon perimeter to provide the geotechnical data necessary to complete the settlement analysis.

### ***Treatment Plant Specifications***

A temporary treatment plant will be used to treat lagoon surface water prior to discharge to the Hackensack River. The hydraulic control treatment plant will be capable of treating the water from the lagoons and may be used in lieu of a temporary plant. The quality of the lagoon surface water and anticipated discharge limits will be considered during treatment plant design. Surface water samples will be obtained to support this activity.

### ***Geogrid Evaluation***

A geogrid material will be specified based upon an evaluation of the lagoon solids. Upon the completion of dewatering operations, any potential soft locations will be identified via probing and final locations for geogrid placement will be specified in the field.

### ***Base Course Evaluation***

Suitable borrow material will be identified for inclusion as the first backfill lift in the lagoon. The need for inclusion of a geogrid within the base course (contingent upon the subgrade support of the underlying materials) will also be evaluated.

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### ***Dust Control***

Although the lagoon solids are expected to be moist, backfill materials will be relatively dry and specification of dust control measures may become necessary for the backfilling operations. During backfilling, dust monitoring will be performed and control measures will be used as necessary and will be considered during generation of specifications for the final design.

### **3.5 NEAR-SHORE SEDIMENT MANAGEMENT**

This component includes removal of river sediments located within 50 feet of the proposed Barrier Wall at the SCCC and Diamond Sites. Although sediment removal is not necessarily required as IRA, the Group acknowledges that some sediment removal may be necessary to accomplish the remedial objective of minimizing potential impacts to the Hackensack River. Consequently, the Group proposes to remove near-shore sediments in conjunction with the IRA. Removed sediments will be conditioned as necessary and will be managed in accordance with the materials management decision flow chart (Figure 1-3). Any material to be consolidated on site (either as a result of AOC Policy approval or a non-hazardous waste classification) will be used as backfill for the lagoons and contained beneath an interim surface cover (Section 3.6). Conditioning of the sediments will be performed to reduce moisture and increase structural strength properties for either onsite use or offsite disposal. Waste classification efforts will be necessary to support the evaluation of the management options for the sediment.

#### **Description:**

Following installation of the barrier wall, near-shore Hackensack River sediments that are potentially impacted with site-related constituents will be removed, conditioned (dewatered/solidified), and either consolidated onsite, treated/disposed offsite, or a combination thereof, as previously discussed. A conditioning study to identify the required additives for dewatering and solidification will be performed during the design data acquisition activities (Section 4.5). As shown on Figure 3-1, sediment located within 50 feet of the proposed barrier wall alignment and to a maximum depth of 3 feet below the sediment surface or until the meadow mat is encountered (if less than 3 feet) will be removed and consolidated and/or treated and disposed.

Given the presence of dioxin congeners in the river sediments, it is tentatively planned that the sediments will be consolidated in the vicinity of the SCCC lagoons because that area also contains dioxin congener-containing materials. Placement of the materials in this location will be contingent upon waste classification and AOC Policy considerations as previously shown in Figure 1-3. Prior to consolidation (or shipment), sediment will be dewatered and conditioned as necessary. Materials to be managed on site (if any) will be placed on site beneath an interim surface cover in the lagoon area. Following removal of the sediments, the shoreline and river bed will be restored.

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**Design Requirements:**

Design requirements for the onsite consolidation of river sediments are:

- Conduct pre-excavation sampling and analysis to support a waste classification determination;
- In the event that the use of the AOC Policy is not approved, identify those portions of the river sediments that are hazardous and therefore not suitable for onsite consolidation;
- Designate an area or areas within the interim surface cover area (Section 3.2.1) as suitable for sediment consolidation;
- Identify backfilling, restoration, and mitigation specifications as necessary;
- Identify dewatering and water management requirements (if any); and,
- Designate performance requirements such that the conditioned and placed sediments have adequate strength to support the interim surface cover component of the response action.

**Design Activities:**

Following collection of the design data, design of the sediment remediation activities will be performed. Sediment remediation will be coordinated with other aspects of the IRA to ensure that adequate access to the sediments is available. In addition, the logistics of sediment management will be considered in view of other ongoing, completed, or planned responses. The following aspects of the proposed river sediment removal and consolidation/disposal efforts will be assessed in detail, to ensure the proposed remedy will fully serve its intended function:

***Volume Estimation***

This design element will consist of: 1) estimating the in-place volume of the sediments to be removed; 2) estimation of the volume of the dewatered sediments (expected to be smaller in volume than the in-place sediments); and, 3) estimation of the final volume of the sediments upon completion of any requisite conditioning.

***Sediment Dewatering***

This aspect of the design will consist of identification of an appropriate means of dewatering the sediments. Gravity dewatering or mechanical dewatering may be conducted although the preferred approach will be to take up the excess moisture via addition of conditioning agents.



### ***Sediment Stockpiling***

This aspect of the design will include identification of an appropriate location for sediment stockpiling prior to placement, under the proposed cover, as appropriate based on the materials management decision flow chart (Figure 1-3). A stockpile location that will not impede other site operations will be identified. In addition, a location where potential runoff from the stockpile can be easily controlled will be identified and an erosion and sediment control plan for the stockpile will be developed.

### ***Sediment Conditioning***

Conditioning of the sediment may be required to meet structural requirements for emplacement of the interim cover or for shipment (i.e., to meet the paint filter liquids test). Addition of Portland cement or other binding agents will likely be used to condition the sediments.

### ***Sediment Placement***

The design will include identification of appropriate areas for placement of the river sediment contingent upon waste classification and AOC Policy status (Figure 1-3) and volume estimation. The SCCC lagoon will be covered as an interim measure and this area is considered an appropriate location for the excavated river sediments as well as the south ditch soft soils given the presence of dioxin congeners in all of these materials. The required lifts and compaction requirements will be identified during the design process.

### ***Restoration Requirements***

Upon completion of the river sediment removal, restoration activities will be completed to restore the sediment bed to the extent practicable and to restore any disturbed areas of the shoreline. Sediment bed restoration will be designed based on a pre-excavation inspection of the area to identify the types of habitat present along each reach of interest (e.g., tidal mud flats). Specific restoration requirements will be established through the permitting process.

### ***Permit Applications***

This design element will consist of the preparation of all required Federal, State, and local permits applications. The required permits are identified in Section 5.0 of this IRAW.

### ***Wetland Mitigation Plan***

A wetland mitigation plan will be prepared that addresses replacement of the ecological and functional value of any intertidal wetlands, freshwater wetlands, and shallow water habitat that may be disturbed during the river sediment removal and placement action. This plan will be submitted to the ACOE, NJDEP LURP, NJMC and the Meadowlands Interagency Mitigation Advisory Committee (MIMAC) for approval.

In addition to the preceding design elements, permitting of the river sediment remediation may entail the preparation of long-term inspection and monitoring plans for both the sediment placement area and the restored sediments. The need for these plans will be identified during the course of the design and permitting process and will be developed as appropriate. These aspects of monitoring and inspection may be incorporated into a universal site inspection and monitoring plan if feasible.

### **3.6 INTERIM SURFACE COVER AND STORM WATER MANAGEMENT SYSTEM**

This component entails construction of an interim surface cover over portions of the SCCC and Diamond Sites. The interim surface cover will be designed to achieve the following: 1) eliminate potential direct contact exposure to impacted soil; 2) mitigate the potential upward migration of hexavalent chromium from the COPR soils; and, 3) reduce the potential for overland runoff of sorbed and dissolved constituents to surface water. The final grading for the interim surface cover will be determined during the detailed design. Fill placement will only occur to the extent necessary to accomplish the preceding objectives. The existing IRM covers on the Diamond Site and portions of the SCCC will be maintained.

#### **Description:**

As shown on Figure 3-1, an interim surface cover will be constructed over portions of the SCCC and Diamond Sites. The proposed surface covers will be comprised of a one-foot thick layer of coarse aggregate underlain by a geotextile fabric. The primary reasons that the interim surface cover is necessary are as follows:

- Elimination of potential direct contact exposure to impacted soil;
- Mitigation of the potential upward migration of hexavalent chromium from the COPR soils; and,
- Reduction of overland runoff of sorbed and dissolved constituents to surface water.

Note that the interim surface cover will act as a protective engineered barrier for materials consolidated on site in accordance with the AOC policy if concurrence with the AOC Policy request is obtained as previously described in Figure 1-3. In the event that such concurrence is not obtained, characteristic hazardous waste will be disposed off site while non-characteristic materials will be consolidated on site beneath the surface cover.

As part of the interim surface cover, the existing stormwater management system will be improved to accommodate the remediation project by retrofitting as required the existing storm sewer between the Diamond Site and the SCCC Site, installing a new storm sewer system along the alignment of the existing ditch at the SCCC Site, and remediating and backfilling the existing south ditch on the SCCC Site. The new storm sewer system will be comprised of:

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- A network of catch basins and headwalls (i.e., inlets);
  - HDPE conveyance piping; and,
  - One or more outfalls to the Hackensack River.

It is currently planned that the new stormwater management system will be comprised of two 2-foot diameter smooth-bore HDPE culverts. The joints will be butt-fused, to preclude groundwater infiltration in areas where the invert of the pipe may lie below the depressed water table.

**Design Requirements:**

The interim surface cover will be designed to achieve the following remediation objectives:

- Prevent potential direct exposure to impacted surface soils;
- Control the potential upward migration of hexavalent chromium from the COPR-impacted soils;
- Maintain existing storm water flow patterns;
- Provide site protection from flooding during peak storm events; and,
- Provide an engineering control over consolidated materials.

The specific performance standards that will be considered in the interim surface cover design are as follows:

- The interim surface cover will provide an engineering control to mitigate the potential for direct contact with impacted soil;
- The interim surface cover will serve as a capillary break to prevent the potential upward migration of hexavalent chromium from the areas of the Diamond and SCCC Sites containing COPR soil; and,
- The surface cover will be designed to accommodate potential settlement of the underlying meadow mat and/or lagoon contents to minimize the potential for ponding.

**Design Activities:**

Data acquisition activities to support the design of the interim surface cover are proposed in Section 4.1.1.1. Design of the interim surface cover component will be completed following the completion of the aforementioned design data acquisition activities. The design deliverables will be comprised of detailed design drawings, technical specifications and a Construction Quality

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Assurance Plan (CQAP). The following aspects of the proposed interim surface cover will be assessed in detail, to ensure that the proposed remedy will fully serve its intended function:

### ***Grading Plan***

An initial design task will be preparation of a surface grading plan for both Sites. At a minimum, revised surface grades will be developed for areas proposed to receive an interim surface cover. The grades will be designed to provide for positive drainage and to provide sufficient capacity between the existing and proposed grades to accommodate the volume of backfill materials (e.g., slurry wall spoils, drainage ditch soft soils, borrow material, etc.) resulting from development of the on-site consolidation areas, if utilized. In addition, minor surface regrading may be completed to augment drainage toward the inlets of the proposed culvert system to be installed in the remediated/backfilled drainage ditch along the southern boundary of the SCCC Site. Finally, the grading plan will reflect the surface grades of the working platform to be constructed in association with installation of the slurry wall. Provisions for site ingress and egress (such as access ramps) will also be included as required.

### ***Layer Specifications***

Interim surface cover components will be designed and specifications will be developed to ensure that the Remediation Objectives and Performance Requirements are achieved. As previously explained, the capillary break layer will be comprised of coarse aggregate underlain by geotextile fabric. Several considerations will be incorporated into the selection of these components, including:

- Capillary break function;
- Physical separation of the underlying soils from the cover system materials; and,
- Accommodation of existing site features, including asphaltic concrete pavement.

### ***Settlement Analyses***

Compressible subsurface layers (meadow mat) and cohesive soils prone to secondary consolidation (varved clays) are known to exist at the sites. In conjunction with the development of a final grading plan for the consolidation area on the SCCC site, an evaluation of settlement will be performed.

### ***Storm Water Management Calculations***

As previously discussed, the existing drainage ditch located along the southern boundary of the SCCC Site will be remediated and backfilled, in preparation for installation of the proposed slurry wall working platform. Discharge rates through the existing ditch are generally constrained by the culvert/tide valve structure located at the outfall of the ditch, adjacent to the Hackensack River. The new culvert system will be sized to, at a minimum, pass the peak discharge provided by the existing system.

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### ***Erosion, Sediment, and Dust Control***

Temporary measures to control erosion, sediment and dust during land disturbance will be incorporated into the design. These measures may include sediment barriers or traps as required to comply with applicable standards.

### **3.7 SITE PREPARATION ACTIVITIES**

In addition to the preceding principal components, other tasks must be performed to prepare the Site for construction of the aforementioned IRA components. These tasks consist of a number of straightforward elements such as security controls, well installation, well refurbishment, and utility protection, relocation or abandonment. In addition, site preparation includes a number of response actions, as follows:

- former process area tank removal;
- former process area tank saddle removal;
- septic tank removal;
- stormwater system repair or replacement;
- transformer pad removal;
- ditch soft soil remediation; and,
- vault contents management.

#### **Description:**

Site preparation includes a wide range of activities that are necessary to prepare the Sites for construction of the IRA. The Site preparation component is comprised of specific and relatively straightforward elements. As such, only a brief discussion of each element is provided in this IRAW. Implementation plans for each element will be developed, as appropriate, as part of the IRA design for construction.

- ***Engineering and Administrative Controls:*** Engineering controls such as fencing, security, and hazard communication will be implemented as part of the response action.
- ***Monitoring Well/Piezometer Installation and Refurbishment:*** Upon completion of a detailed design for the interim surface cover and development of the groundwater monitoring programs, a plan to install, abandon, and/or refurbish (e.g., extend) groundwater monitoring wells will be developed.
- ***SCCC Containerized Materials:*** Various materials requiring management have been containerized and are stored at the SCCC Site. If possible, based on the availability of viable off-site disposal options, these materials will be disposed off site as part of the IRA. If materials cannot be disposed off site, a specific proposal to consolidate

these materials on site beneath a final surface cover will be provided to the NJDEP as part of the final remedy.

- **SCCC Septic Tanks:** The SCCC Site reportedly has two (2) former septic tanks. As part of site preparation, the septic tanks will be decommissioned appropriately, in accordance with N.J.A.C. 7:9A-12.8 and local requirements. Tank contents will be sampled and recovered for offsite disposal. The tanks will then be removed and disposed off site. Confirmatory soil sampling and analysis will be completed.
- **Storm Sewer:** The storm sewer between the SCCC and Diamond Sites will be retrofitted as appropriate in conjunction with the development of a comprehensive storm water management system for the Sites.
- **SCCC Transformer Pad:** The SCCC Site has a concrete pad requiring remediation for PCBs. The concrete pad will be ultimately be removed in its entirety and disposed off site. Confirmation soil samples will be collected from the area beneath the pad following its removal. Samples will be collected for PCB analysis at a sample frequency of 1 PCB sample per 900 square feet (sf) in accordance with the sample frequency outlined in N.J.A.C. 7:26E-3.9(b)ii. If the confirmatory sampling indicates that additional delineation is required underneath the pad, then additional sampling and analysis will be completed. These activities will be completed after the IRA designs are finalized.
- **SCCC Ditch Soft Soils:** The existing ditch on the southern boundary of the SCCC Site contains soft soils that will be excavated and managed either off site or on site (per the decision flowchart provided as Figure 1-3) to accommodate installation of the slurry wall and stormwater controls.
- **SCCC Vault Contents:** The vault contents consist of approximately 600 gallons of viscous petroleum-based non-aqueous phase liquid contained within a small and shallow below-grade concrete vault in the central portion of the SCCC Site. The material has been characterized and a Waste Classification Request Form (HWM-009) was submitted to the NJDEP on October 25, 2006. To date, the NJDEP has not acted upon this waste classification request. Following the receipt of the waste classification determination from the NJDEP, arrangements will be made for the offsite disposal of the vault contents. Following removal of the contents, the vault will be backfilled with clean fill.
- **Utility Protection, Relocation, or Abandonment:** Utilities will be protected, relocated or abandoned as appropriate during implementation of the IRA.
- **Clearing and Grubbing:** Prior to construction of the cover system, appropriate portions of the Sites will be cleared and grubbed to prepare the Site for cover installation.

- ***Access Road Improvement and Construction:*** Access roads will be constructed as needed to facilitate implementation of the IRA.
- ***Maintenance of Function of Existing IRMs:*** Existing IRMs must be maintained throughout the investigation and remediation of the sites to minimize airborne release of hexavalent chromium and volatile organics substances to the atmosphere.

**Design Requirements:**

The site preparation component of the response will be designed to be consistent with the proposed interim response actions at the Sites.

**Design Activities:**

Design activities will include the following tasks:

- Prepare a Construction Quality Assurance Plan (CQAP) for site preparation activities;
- Determine final disposal requirements for contents of the septic tanks and for the transformer pad;
- Prepare an Erosion and Sediment Control Plan;
- Prepare a Well Protection, Abandonment, or Refurbishment Plan;
- Determine need for installation/repair of security fencing;
- Prepare a Transportation Plan acceptable to the NJMC that identifies construction, hauling, and general traffic flow on the property;
- Determine utility needs and prepare a utility abandonment or upgrade plan;
- Prepare health and safety protocols to be followed during implementation of the remedy;
- Obtain a jurisdictional determination for the delineated wetlands on the Sites. A map showing the results of the recent wetland delineation performed by Princeton Hydro LLC is included in Appendix B;
- Prepare applications and obtain necessary permits identified in Section 5.0; and,
- Confirm by field survey the property boundaries and prepare an existing conditions site plan.

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## **4.0 DESIGN DATA ACQUISITION ACTIVITIES**

This section identifies additional investigative activities required to provide the site physical and chemical data necessary to complete the design of the Interim Response Actions. The activities include, but are not limited to, collection of geotechnical data to support barrier wall and interim surface cover design, collection of data to support waste classification, collection of data to verify design of the hydraulic control and DNAPL recovery systems, the groundwater treatment plant, and requisite permit applications. As part of the design data acquisition activities proposed herein, the necessary planning documents (i.e., Health and Safety Plan (HASP), Quality Assurance Project Plan (QAPP), and Field Sampling Plan (FSP)) have been prepared. The HASP, QAPP, and FSP are included as Appendices C, D, and E, respectively. The scope of the sampling and analysis program is summarized in the attendant QAPP and FSP and is discussed in detail in the remainder of this section. Appendix F includes the curricula vitae of key personnel who will participate in the implementation of the approved IRA.

### **4.1 BARRIER WALL DATA ACQUISITION**

As described in Section 3.0 of this plan, soil borings and subsequent laboratory testing will be required to obtain additional data necessary to complete the design of the barrier wall system. These investigative activities are described in detail the remainder of this subsection.

#### ***Geotechnical Data Acquisition***

Soil borings will be completed at approximately 200-foot intervals along the proposed riverside barrier wall alignment and at approximate 400-foot intervals along the northern, western, and southern alignments, to provide stratigraphic information necessary for detailed design as well as to afford collection of representative soil samples for subsequent geotechnical laboratory testing. The soil boring program will also provide information regarding the possible presence of subsurface obstructions (if any) along the proposed alignment that may require removal by excavation in advance of barrier wall installation.

A total of 20 soil borings (BW-1 through BW-20) are currently proposed for installation along the proposed barrier wall alignment [seven (7) along the Hackensack River segment and 13 along the remaining site perimeter segments]. The locations of these soil borings are depicted on Figure 4-1. Two (2) additional “in-river” soil borings (GT-6 and GT-7) and one (1) additional inland soil boring (GT-5) are also proposed, as shown on Figure 4-1.

Soil borings will be advanced using HSA drilling techniques. Soil borings BW-1 through BW-7, and soil borings GT-5 through GT-7 will be completed to a minimum depth of 60 feet below ground surface (bgs) to allow for acquisition of geotechnical data to support the structural design of the sheet pile wall. Soil borings BW-8 through BW-20 will be completed to a minimum depth of 30 feet bgs (which corresponds to an elevation of approximately ten feet below the top of the varved clay unit). Split-spoon samples will be collected for visual identification of soil type(s)



by the field geologist/engineer on a continuous basis until the meadow mat is encountered, and then on a 5-foot vertical spacing until each soil boring is completed. Additional representative undisturbed samples of cohesive soil strata (i.e., the meadow mat and varved clay layers) will be obtained using Shelby tube sampling techniques.

Soil boring abandonment, drill cutting management procedures, and survey requirements (landside borings only) will be as described in the attendant Field Sampling Plan (Appendix E).

A geotechnical laboratory will be retained to perform testing on representative soil samples obtained from the subsurface investigation. The proposed testing program is extensive as a result of the anticipated presence of relatively weak soil deposits (as observed on the adjacent Seaboard Site) that may compromise that lateral earth support provided by the subgrade soils. Geotechnical sample testing will be performed in accordance with applicable ASTM standards. A summary of the proposed geotechnical laboratory testing program is as follows:

- USCS Classification
- Moisture Content
- Gradation
- Hydrometer Analysis
- Atterberg Limits
- Specific Gravity
- One-Dimensional Consolidation
- Consolidated Undrained Triaxial Shear (3 points each)
- Permeability
- Bulk Density

### ***Chemical Analytical Data Acquisition***

In addition to the geotechnical samples, three vertical grab samples will be obtained from each of the barrier wall alignment borings for analyses to support a request for a waste classification determination. A grab sample will be obtained from each of the stratigraphic zones (one from the shallow fill, one from the meadow mat, and one from the deeper sand). Hence, a total of 60 additional samples will be obtained from these borings (3 samples per boring from 20 borings). The samples will be analyzed for constituents to support waste classification, as follows:

- Target Compound List (TCL) Volatile Organics
- TCL Semi-volatile Organics
- Target Analyte List (TAL) Metals and Cyanide
- Polychlorinated Dioxins and Dibenzofurans
- Polychlorinated Biphenyls
- Hexavalent Chromium
- Toxicity Characteristic Leaching Procedure (TCLP) Volatile Organics
- TCLP Semi-volatile Organics

- TCLP Metals
- RCRA Characteristics (Ignitability, Reactivity, Corrosivity)

### ***Mix Design Data Acquisition***

It is currently planned that un-impacted materials from the deeper sand unit will be incorporated into the slurry wall mix. Hence, representative samples of these potential backfill materials will be obtained during the barrier wall alignment boring completion program. These samples will be subjected to mix testing to determine appropriate admixture rates to achieve the final desired permeability. The requisite number of samples and required sample volumes will be determined via consultation with a slurry wall mix design contractor during the design process.

## **4.2 HYDRAULIC CONTROL SYSTEM DATA ACQUISITION**

Information will be collected to verify the design of the hydraulic control and groundwater treatment system and to support the NJPDES Discharge to Surface Water Permitting process. This information includes collecting updated chemical-analytical data for support of the Permit Application, to verify process design, and for optimization testing. These activities are described in the remainder of this section.

### ***Chemical-Analytical Data***

The Group plans to conduct a comprehensive sampling event to verify the final design of the treatment system and support the NJPDES Permit Application requirements with more recent analytical information. A total of 24 (16 shallow and 8 deep) existing site-wide monitoring wells will be sampled during the event. Sample locations are depicted on Figure 4-1. Samples will be obtained from the following wells:

<b><u>Shallow Fill Unit</u></b>		<b><u>Deeper Sand Unit</u></b>
113-W-113	SC-PZ-3U	SC-MW-2L
113-W-114	SC-PZ-4U	SC-MW-3L
113-W-115	SC-PZ-5U	SC-MW-4L
113-W-116	SC-PZ-12U	SC-MW-12L
113-W-121	SC-PZ-14U	SC-MW-13L
SC-PZ-1U	SC-PZ-15U	SC-MW-14L
SC-PZ-2U	MW-109	SC-MW-15L

Samples will be obtained in accordance with the procedures outlined in the FSP (Appendix E). Based upon the General Permit Request for Authorization (RFA) Checklist for the Category BGR (NJDEP, Revised March 2007), samples should be analyzed for the following suite of analytical parameters:

- TCL Volatile Organics
- TCL Semivolatile Organics

- 
- TAL Metals
  - TCL Pesticides and Polychlorinated Biphenyls
  - Total Suspended Solids
  - Oil and Grease
  - Total Organic Carbon

Samples will also be obtained and analyzed for the following analytical parameters:

- Hexavalent Chromium
- Alkalinity
- Total Dissolved Solids
- Biological Oxygen Demand
- Chemical Oxygen Demand

Finally, field measurements of the following will be completed:

- pH
- Oxidation-Reduction Potential (ORP)
- Specific Conductance
- Temperature
- Turbidity
- Water Levels
- DNAPL Thickness

### ***Bench-Scale Testing***

Bench-scale testing will be completed to verify the selected reagents for hexavalent chromium reduction and to verify precipitation and flocculation of inorganics are optimal for removal of metals. Bulk samples of groundwater will be collected and a pro-rated mixture from targeted wells will be prepared to simulate anticipated influent groundwater quality under actual pumping conditions. The verification testing will be required to support the NJPDES Permit application. The specified reductants, pH control chemicals (acid/base), and anionic and cationic polymers will be tested at varying concentrations to optimize the treatment processes. Titrations, jar testing, and testing of alternative reagents will also be completed. The optimized treatment process will be field-implemented and precipitate allowed to settle so that a representative sample of precipitated sludge and supernatant can be collected for characterization. Settleable solids and moisture content will be measured to support the NJPDES Permit Application. Granular activated carbon (GAC) isotherm testing will also be conducted to verify that the selected GAC is the proper media for removal of organics and to verify adsorber sizing.

### ***Discharge Limits***

Final discharge limits will be established pursuant to the NJPDES permit application and Treatment Works Approval process. Expected discharge limits for the SE-2 section of the

Hackensack River are outlined in the Part III – Attachment BGR of the NJPDES General Permit NJ0155438. Best available technology-based limits may also be considered during the permitting process as necessary to meet the water quality criteria for this reach of the Hackensack River.

#### **4.3 DNAPL RECOVERY SYSTEM DATA ACQUISITION**

The DNAPL recovery system has been configured based on review of historic DNAPL measurements/observations and geologic information regarding the topography of the surface of the meadow mat and the varved clay. Additional data regarding the distribution of DNAPL will be acquired during the RI to be conducted at a later date. The DNAPL recovery system to be installed as an IRA may be expanded based on the RI data collection activities. For the purposes of the IRA, the primary information necessary for verification of the DNAPL recovery system design is geotechnical information (for verifying screen size selection and lengths) and physical/chemical testing of the DNAPL.

##### ***DNAPL Recovery Borings***

Six borings will be completed in the vicinity of the proposed DNAPL recovery well locations to collect information for verification of slot size and screen length. Several geotechnical borings are located near proposed DNAPL recovery locations, and the information required for the DNAPL recovery system design will be obtained from these geotechnical borings. Specifically, data from geotechnical borings GT-3 and GT-4 (to be installed proximate to the SCCC lagoons as subsequently discussed) will provide supplemental data for the DNAPL recovery system design. Samples of the shallow fill and deep sand units will be obtained from each of these eight borings (DNAPL system borings DS-1 through DS-6 and geotechnical borings GT-3 and GT-4). Samples will be characterized for the following:

- USCS Classification
- Gradation
- Hydrometer Analysis

##### ***DNAPL Physical Testing***

Determination of the physical properties of the Site DNAPL is necessary to verify the design of the DNAPL recovery facilities. Two DNAPL samples will be collected from existing monitoring wells and analyzed for the following to verify design data (i.e., well screen slot size, and gravel pack size/gradation):

- Specific Gravity
- Interfacial Tension
- Viscosity

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Because of the differing chemical composition of DNAPL in the lagoon area versus the Building 2 area, one sample will be collected from each of these areas.

### ***DNAPL Chemical Testing***

To determine disposal and recycling options for the recovered DNAPL, two samples of DNAPL (one from the lagoon area and one from the Building 2 area) will be analyzed for the following suite of parameters:

- TCLP Volatile Organics
- TCLP Semi-volatile Organics
- TCLP Metals
- Hexavalent Chromium
- Polychlorinated Dioxins and Dibenzofurans
- Polychlorinated Biphenyls
- Total Organic Halogens (TOX)
- Moisture Content
- RCRA Characteristics (Ignitability, Reactivity, Corrosivity)
- British Thermal Unit (BTU) Content

Sampling results will be compared to the TCLP limits for RCRA wastes and to typical recycling acceptability criteria for fuel blending or fuel stock.

## **4.4 LAGOON DEWATERING AND BACKFILLING DATA ACQUISITION**

Water quality information, waste classification information, and geotechnical information will be generated to support the detailed design of the lagoon dewatering and backfilling component of the IRA. Each of these data acquisition components are discussed in the remainder of this section.

### ***Water Quality Data Acquisition***

Water quality data for the standing water in the lagoons will be obtained to identify appropriate treatment technologies for the lagoon surface waters. It is planned that two samples will be obtained from each of the lagoons and that these samples will be analyzed for the following parameters:

- TCL Volatile Organics
- TCL Semi-volatile Organics
- TAL Metals
- Total Dissolved Solids
- Total Suspended Solids
- pH
- Oxidation-Reduction Potential

- 
- Specific Conductance
  - Temperature
  - Turbidity

### ***Waste Classification Data Acquisition***

Samples of the lagoon solids will be obtained to support a request for a waste classification determination to help determine the options available for a final remedy. These samples will be obtained prior to backfilling to facilitate sample acquisition. Ten lagoon solid samples will be obtained from the locations depicted on Figure 4-1. The samples will be vertical composites of the lagoon contents with the exception of the portion for volatile organic analysis, which will be obtained as a discrete grab sample. The lagoon solid samples will be analyzed for the following suite of parameters:

- TCL Volatile Organics
- TCL Semi-volatile Organics
- TAL Metals and Cyanide
- Polychlorinated Dioxins and Dibenzofurans
- Polychlorinated Biphenyls
- Hexavalent Chromium
- TCLP Volatile Organics
- TCLP Semi-volatile Organics
- TCLP Metals
- RCRA Characteristics (Ignitability, Reactivity, Corrosivity)
- BTU Content

### ***Geotechnical Data Acquisition***

To support settlement analysis, four soil borings will be completed around the perimeter of the lagoons. Blow counts will be recorded during the drilling program to support the settlement analysis. In addition, undisturbed samples of the meadow mat will be obtained for geotechnical characterization if the meadow mat is found to be suitable for such sampling (i.e., if the meadow mat consists of cohesive rather than fibrous materials). If applicable, the meadow mat samples will be analyzed for the following:

- USCS Soil Classification
- Moisture Content
- Gradation
- Hydrometer Analysis
- Atterberg Limits
- Consolidated Undrained Triaxial Shear (3 points each)

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## **4.5 NEAR-SHORE SEDIMENT MANAGEMENT DATA ACQUISITION**

The near-shore Hackensack River sediments adjacent to the Standard Chlorine and Diamond sites will be characterized in anticipation of placement within the AOCs, offsite disposal, or a combination thereof (Figure 1-3). Design data acquisition will consist of collection of data to determine the suitability of the material as structural fill and to provide the data necessary for waste classification. A protocol for testing dredged material for use as structural fill is outlined in “The Management and Regulation of Dredging Activities and Dredged Materials in New Jersey’s Tidal Waters” (1997 Dredge Manual) and is described in the NJDEP LURP WFD/WQC and ACOE permit applications.

The area targeted for removal extends the entire length of the riverbank along the two sites (approximately 1,200 feet), 50 feet into the river and to a maximum vertical depth of 3 feet. Thus a total of approximately 6,700 cubic yards will be removed from the channel, conditioned to attenuate moisture and improve strength, and managed per the decision flowchart provided as Figure 1-3.

Based upon the Dredge Manual guidance, a minimum of three core sediment samples are required. Per the Dredge Manual and to support waste classification, a total of six (6) sediment samples are planned, three (3) adjacent to each of the Sites as depicted on Figure 4-1. Sample collection will be completed in accordance with the NJDEP FSPM, the 1997 Dredge Manual, and the Field Sampling Plan provided as Appendix E. Samples of the upper three feet of sediments will be collected from each location. Each core sample will be homogenized into one sample representative of the entire core interval, with the exception of the portion for volatile organic compound analysis. A grab sample from the vertical midpoint of each core sample will be obtained for VOC analysis. Each sample will be analyzed for the following suite of constituents:

- TCL Volatile Organics
- TCL Semi-volatile Organics
- TAL Metals and Cyanide
- Polychlorinated Dioxins and Dibenzofurans
- Polychlorinated Biphenyls
- Hexavalent Chromium
- TCLP Volatile Organics
- TCLP Semi-volatile Organics
- TCLP Metals
- RCRA Characteristics (Ignitability, Reactivity, Corrosivity)
- Grain Size
- Total Organic Carbon
- Moisture Content

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#### **4.6 INTERIM SURFACE COVER AND STORM WATER MANAGEMENT SYSTEM DATA ACQUISITION**

Data required to complete the surface cover design will be obtained as a result of data acquisition completed for other components of the IRA. Specifically, the geotechnical data obtained as a result of the lagoon backfilling component will support the surface cover design from the perspective of the settlement analysis. Similarly, waste classification information will support the estimation of quantities and hence will support development of the final grading plan. The mix design information generated as a result of the barrier wall data acquisition task will also provide information to be considered in the surface cover design given that the mix design may have an impact on the volume of spoils to be managed versus backfilling of the material in the slurry trench.

#### **4.7 SITE PREPARATION ACTIVITY DATA ACQUISITION**

Major components of site preparation activities include the management of the south ditch soft sediments, management of the former transformer pad, management of former septic tanks, and management of existing containerized materials. Waste classification determinations will be requested from the NJDEP Waste Classification Unit for materials destined for off-site disposal. These materials will include but not necessarily be limited to the following:

- South ditch soft sediments
- Concrete from the transformer pad
- Septic tank contents
- Existing containerized materials (where feasible)

To accommodate slurry wall installation and stormwater management system upgrades, the south ditch soft sediments will be excavated (an average depth of 2 feet and an average width of 10 feet along the length of the ditch) and either managed on site or off site per the material management decision flowchart (Figure 1-3). Contingent upon the outcome of the AOC Policy process and waste characterization, the south ditch soft soils may be conditioned as necessary and placed in the west lagoon as previously discussed. Waste classification will be completed for the south ditch soft sediments. Proposed sampling locations for the south ditch soft sediments are depicted on Figure 4-1. The planned analytical suite for the soft sediment samples is as follows:

- TCL Volatile Organics
- TCL Semi-volatile Organics
- TAL Metals and Cyanide
- Polychlorinated Dioxins and Dibenzofurans
- Polychlorinated Biphenyls
- Hexavalent Chromium
- TCLP Volatile Organics
- TCLP Semi-volatile Organics



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- TCLP Metals
  - RCRA Characteristics (Ignitability, Reactivity, Corrosivity)

Sampling and analysis of the remaining materials will be conducted in accordance with the NJDEP Guidance Document for Waste Classification. If an alternate sampling approach is desired by the Group, it will provide an alternative sampling plan to the NJDEP for review and approval in accordance with the Guidance Document for Waste Classification.

A site inspection will be performed to verify the locations and sizes of the septic tanks at the site. One sample of liquid and of solids will be collected from each septic tank to characterize the contents and determine disposal requirements. Each sample will be analyzed for the following:

- TCL Volatile Organics
- TCL Semi-volatile Organics
- TAL Metals
- Polychlorinated Biphenyls

Solid samples obtained from the septic tanks will also be tested for RCRA Characteristics (Ignitability, Reactivity, and Corrosivity).

After the septic tank contents are characterized and removed the tanks will be removed and demolished per Town of Kearny requirements. The excavation will be backfilled per Town of Kearny requirements. Locations will be staked for subsequent survey.

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## **5.0 PERMITS**

Implementation of the IRAW at the Diamond and SCCC sites will require Federal, State and Local authorizations, permits, and/or approvals. The specific type of Federal, State or Local authorizations required and associated permit condition(s) will be dictated by the nature of the activity and its location.

The development of a clear, concise approach to permitting will allow the attainment of the needed authorizations in a timely manner. In this case, it is important that the “need” for the project be established as remedial in nature to utilize general or “nationwide” permits where possible. Based upon the scope of the project identified in this IRAW, several permits and or plan approvals will be required to implement the remediation project. The permits or plan approvals anticipated to be required for the two sites are as follows:

### **NJDEP Permits or Plan Approvals**

- IRAW Approval;
- LURP Waterfront Development Permit/Stream Encroachment Permit/Acceptable Use Determination/Freshwater Wetlands General Permit and Water Quality Consistency Determination;
- Tidelands Grant; and,
- NJPDES Discharge to Surface Water General Permit and Treatment Works Approval.

### **Federal Permits or Approvals**

- ACOE Section 10 of the Clean Rivers and Harbors Act and Section 404 of the Clean Water Act; and,
- EPA Region II Resource Conservation and Recovery Act Policy on Areas of Contamination at Facilities Containing Hazardous Waste.

### **Local Permits or Approvals**

- Certification of Soil and Erosion Sedimentation Control Plan (HEP SCD);
- NJMC Zoning Certificate; and,

- Town of Kearny – Construction Permit for authorization to perform regulated activities.

For a remediation driven project, such as this one, permit applications are usually prepared and submitted following NJDEP approval of a RAW or similar document prepared in accordance with N.J.A.C. 7:26E and once the detailed design has progressed to the necessary level of completion. As an initial permitting task, pre-application conferences would be requested with the various permitting authorities to present the proposed remediation project and to verify that all required permits and authorizations have been identified. A pre-application package will be prepared that will: 1) illustrate the design features of the project applicable to the specific permit; 2) identify assumptions regarding requirements to be addressed; and, 3) outline the level of detail that will be provided in the respective permit applications. It is anticipated that pre-application conferences will be requested with the ACOE, NJDEP NPDES, the NJDEP LURP, and the NJMC. Joint pre-application meetings with the permitting authorities may be conducted in an effort to coordinate permit applications. The Group will request that the Case Manager from NJDEP Office of Brownfield Reuse (OBR) participate in these pre-application meetings.

The following sections provide additional details associated with the permits and plan approvals that have been tentatively identified for the project including a description of the remedial component or activity that triggers the respective permit. These sections have been segregated into: 1) NJDEP; 2) Federal; and, 3) Local permits or plan approvals.

## **5.1 NJDEP PERMITS OR PLAN APPROVALS**

### **IRAW**

The NJDEP, OBR and BCM are the approving authorities within the NJDEP that are responsible for review and approval of the IRAW for the SCCC Site and Diamond Sites, respectively, in accordance with the ACO.

### **NJDEP Land Use Regulatory Program (LURP) Permits**

The NJDEP's LURP regulates land use under three main permit rules: Coastal [Waterfront Development (WFD)], Stream Encroachment (SEP), and Wetlands. It is anticipated that a joint LURP permit application will address all three of the main permit rules.

A WFD Permit will be required for activities occurring below the mean high water (MHW) elevation (approximately 3 feet msl) and a SEP will be required for activities occurring in the 100-yr flood plain (up to approximately elevation 10 feet msl). The project will also require a Water Quality Certificate (WQC) for placement of fill materials. It is assumed that a combined WFD/SEP and General Wetlands permit approval would incorporate the Department's approval of a WQC.

A Wetlands General Permit No. 4 (GP 4) will be required for disturbance and mitigation of site wetlands. According to the wetlands survey completed by Princeton Hydro, LLC (Appendix B), emergent estuarine (tidal) wetlands have been identified on the river side of the proposed barrier wall. Also, as reported in the wetland survey, tidal and freshwater emergent (freshwater) wetlands have been identified in some of the swales, ditches and lagoons and water courses along the southwest SCCC property line. Both freshwater and tidal wetlands will be disturbed during implementation the IRAW. As discussed in the Federal Permits section below, the ACOE has jurisdiction over wetlands at the site. However, the NJDEP LURP will also require that a GP 4 be issued for disturbance and mitigation of the tidal wetlands. It is anticipated that the GP 4 would require an endorsement by the Meadowlands Interagency Mitigation Advisory Committee (MIMAC).

Major remedial activities triggering the LURP combined WFD\SEP and General Wetlands Permit include:

- **Barrier Wall System** - Proposed construction of the barrier wall system described in Section 3.2.2 consisting of: 1) slurry wall along the entire combined perimeter of both the SCCC and Diamond Sites (i.e., the northern property boundary of the Diamond site, the western property boundary of both Sites, and the southern SCCC sites boundary); and, 2) steel sheet pile wall along the Hackensack River connecting to the steel sheet pile wall at the neighboring Seaboard Site. The steel sheet pile wall along the Hackensack River will be installed at a location on the river bank corresponding to mean high water elevation of approximately 3 ft msl and will have a minimum top elevation equivalent to the 100-Year Flood Level of approximately 10 ft msl.
- **Sediment Removal and Management** - Disturbance and subsequent mitigation of tidal wetlands and shallows necessitated by excavation of approximately 6,700 cubic yards of near-shore Hackensack river sediments. The sediments will be excavated to a maximum distance of 50 ft from the steel sheet pile wall and to a maximum depth of 3 ft. The majority of the sediment excavation is anticipated to occur below mean high water. Sediments will be conditioned on site and managed in accordance with the materials management decision flowchart (Figure 1-3).
- **Drainage Ditch Soft Soils** – Excavation of the soft soils and management in accordance with the material management decision flowchart (Figure 1-3) and replacement of the drainage ditch with a piped stormwater management system.
- **Interim Surface Cover** - Placement of materials as the interim surface cover over portions of the Sites. Construction of a network of catch basins and conveyance piping, and one or more outfalls to the Hackensack River (the proposed stormwater control system) associated with the interim surface cover and barrier wall system. The temporary stormwater and soil erosion and sedimentation control plans associated with construction of the interim surface cover may also require

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sedimentation basins, traps, and or mechanical devices to attain stormwater standards contained in N.J.A.C. 7:8-Subchapter 5.

- DNAPL Recovery System - Installation of DNAPL recovery system consisting of recovery wells with groundwater treatment and offsite DNAPL recycling or treatment/disposal.

### **NJDEP LURP Bureau of Tidelands Management - Tidelands Grant**

Tidelands, also known as riparian lands, are all those lands now or formerly flowed by the mean high tide of a natural waterway. If present, these lands are owned by the State of New Jersey. As a result, the applicant must obtain permission from the State to use these lands, in the form of a tidelands license, lease, or grant. The Tideland Application is submitted to LURP, Bureau of Tidelands Management and reviewed and approved by the Tidelands Resource Council.

### **NJPDES Discharge to Surface Water and Treatment Works Authorization Permit**

A NJPDES Discharge to Surface Water Permit and Treatment Works Authorization (DSW\TWA) is required for the treatment of remedial water from the hydraulic control and DNAPL recovery systems. As discussed in Section 3, groundwater extracted as part of the hydraulic control and DNAPL recovery system operations will be treated and discharged into the Hackensack River. For this reason, a NJPDES Discharge to Surface Water (NJPDES-DGW) permit is required for this activity. An application will be prepared for inclusion under the Statewide Final General Remediation Clean-up Permit (GRC) No NJ0155438. This General Permit authorizes the discharge of remedial groundwater to surface waters of the state. This permit provides information for the Treatment Works Approval (TWA) application, which will allow the Department to verify the specific treatment system design and significant operational requirements. The NJDEP OBR will also be responsible for approving plans to close the five (5) septic system tanks.

### **Hudson Essex Passaic Soil Conservation District (HEP SCD) - Discharge to Surface Water Permit and Soil Erosion and Sediment Control Plan Certification**

A New Jersey Pollution Discharge Elimination System, Discharge to Surface Water (NJPDES-DSW) permit is required. This permit is required pursuant to N.J.A.C. 7:8. The NJPDES-DSW permit regulates the construction of the proposed stormwater management system. Permits are submitted to the HEP SCD who is the authorized permitting agency for the NJDEP, Division of Water Quality, Bureau of Non-Point Pollution Control, the agency responsible for the permit.

A Soil Erosion and Sediment Control Plan (SE&SC) Plan for the proposed site construction activities will be required for certification by the HEP SCD. The SE&SC certification is based on compliance with the publication entitled Standards for Soil Erosion and Sediment Control in New Jersey (SESCNJ) modified in July 1999. Certification of the SE&SC plan is required because up to 52 acres will be temporarily disturbed as a result of the IRAW remedial activities.

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The IRAW remedial activities are considered a Category D (land grading, demolition and landfills) activity.

## **5.2 FEDERAL PERMITS OR PLAN APPROVALS**

### **ACOE Section 10 of the Clean Rivers and Harbors Act and Section 404 of the Clean Water Act**

The ACOE regulates the navigable waters of the United States, as well as hydraulically-connected wetlands. In this case, authorization from the ACOE will be required for activities occurring below the mean high surface water elevation (approximately 3 ft msl), such as dredging of sediments or placement of fill/structures associated with the proposed stormwater control system, or any long or short-term impacts associated with construction of the barrier wall below the mean high water elevation. While the proposed barrier wall plans call for construction above mean high water, construction may require an ACOE permit because it is anticipated that one or two culvert headwalls will be installed with inverts below mean high water. As indicated previously, the wetlands survey identified both tidal and freshwater wetlands on site, some of which will be impacted by the remedial activities. Removal of river sediments, construction of portions of the barrier wall, the installation of the headwalls of the proposed stormwater control system, ditch soft sediment removal, and placement of the interim surface cover will result in disturbance of some of these wetlands. For this reason, in addition to NJDEP LURP permits, a permit from the ACOE will also be required.

Based upon precedence at similar sites, the ACOE may require that an individual permit under Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act be obtained for the combined remediation and redevelopment project. However, since the “need” for the project is remediation, a request for a Nationwide Permit 38 for the project is considered appropriate for permit acquisition. Nationwide permits are prescribed in the December 13, 1996 Federal Register, Final Notice of Issuance, Reissuance, and Modification of Nationwide Permits (61 FR 65874).

Permits triggered by specific activities requiring authorization under the Nationwide Permit 38 include the following:

- Jurisdictional Wetlands Determination – The applicant must seek a jurisdictional determination of the extent of waters of the United States regulated by the ACOE within the applicant’s property boundary.
- General Permit No. 7 – construction of one (1) or more outfalls to the Hackensack River, potential temporary disturbance resulting from the barrier wall construction activity, excavation/dredging below mean high water of near-shore Hackensack River sediment and removal via excavation and dredging prior to subsequent onsite consolidation, restoration of river bank areas (wetlands compensation and shallows mitigation), and placement of backfill materials into wetlands.

These permit applications will require applicant's receipt of the WQC or waiver described in NJDEP LURP permit applications, and a Coastal Zone Management Consistency Concurrence or waiver from the NJDEP.

### **EPA – Concurrence Regarding the Applicability of the Use of EPA's Area of Contamination Policy**

The NJDEP has requested that the Group submit a written request, supported by maps and data, for the use of EPA's AOC Policy. The NJDEP will forward this request to the EPA to get a determination as to whether the proposed activities are consistent with the AOC policy. The use of this policy for the project would permit the management of certain materials at the site without triggering RCRA requirements such as the Land Disposal Restrictions (LDRs) or Minimum Treatment Requirements (MTRs). It is currently anticipated that near shore Hackensack River sediment, drainage ditch soft sediment, slurry wall spoils, trench spoils, and if necessary, certain containerized materials will be managed in the AOCs if approved. A materials management decision flowchart was previously provided as Figure 1-3.

## **5.3 LOCAL PERMITS OR PLAN APPROVALS**

### **NJMC Zoning Certificate**

Because the project site is located within the New Jersey Meadowlands, most remediation and redevelopment activities will require authorization under a NJMC Zoning Certificate in accordance with 37 N.J.R. 2555. Provided that the activities are authorized by the NJDEP for remediation, the attainment of the zoning certificate should be straightforward. The NJMC will have to approve the final site plan for the site, and end-use factors such as traffic, landscaping, and noise may need to be addressed. Typically, following IRAW approval and final design, an application to the NJMC for a comprehensive zoning certificate would be submitted.

Specific activities requiring authorization by the NJMC District Zoning Regulations and Certificates include the following:

- Construction of the interim surface cover previously described. Activities would include construction of temporary access roads, placement of fill materials in temporary stockpiles, the proposed storm water control system, demolition of structures, temporary trailers, signage, and installation of utilities;
- Construction of the barrier wall system previously described. Temporary material handling and mixing areas on the Diamond and SCCC Sites will be necessary for the slurry wall;
- Sediment removal and management as previously described. Sediment removal via excavation and dredging, dewatering, conditioning and onsite consolidation of 6,700

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cubic yards of near-shore Hackensack River sediments into temporary material handling, drying and sediment conditioning area and restoration of the river bank. These activities will also include removal of onsite drainage ditch soft soils located along the southern boundary of the site;

- Mitigation of wetlands permitted to be disturbed during implementation of the IRAW; and,
- Installation of temporary construction trailers for remedial activities.

Similar activities were found to be consistent with the Commission's Heavy Industrial Zoning Regulations and were permitted by NJMC at the Seaboard Site.

### **Town of Kearny Construction/Building Permits - Construction/Demolition Permits**

Various construction permits will be required by the Town of Kearny. Remedial measures that are considered regulated activities, and the associated local permits required include:

- Demolition work necessary to remove the transformer pad, requiring a Construction Permit (identified as "Demolition Activity") from the Town of Kearny Building Sub Code Official; and,
- Demolition work necessary to remove and backfill two septic system excavations, requiring a Building Permit (identified as "Other Activity") from the Town of Kearny Plumbing Sub Code Official.



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## **6.0 IRA COST ESTIMATE**

A cost estimate for implementation of the IRA has been developed. Details regarding the cost estimate are provided in Table 6-1. Capital costs, operation and maintenance costs, and the present worth of the IRA are summarized in Table 6-1. Operation and maintenance costs were determined assuming a two-year time frame. This is predicated on the assumption that a final remedy is implemented within that time frame. The following costs are projected based on the planned IRA:

- Capital Cost: \$ 8,591,300
- Annual O&M Cost: \$ 808,000
- Present Worth: \$ 9,399,300

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## **7.0 IRA SCHEDULE AND REPORTING**

### **7.1 IMPLEMENTATION AND SCHEDULE**

Implementation of the IRA will require careful planning to coordinate a considerable number of tasks. Figure 7-1 is a Gantt chart representation of the anticipated design and permitting schedule. This schedule provides starting dates, durations, and end dates for the major project tasks and subtasks, established through a critical path methodology. Major schedule components include design data acquisition activities, preparation of design drawings and technical specifications, and permitting activities. Note that given the dynamic nature of the project, the schedule may need to be updated and revised as warranted throughout the project. Any modifications to the project schedule will be promptly communicated to the NJDEP.

### **7.2 CONSTRUCTION DESIGN**

Upon conclusion of the data acquisition tasks, construction design documents relative to this IRAW will be submitted to the NJDEP. The following elements will be included:

- Barrier Wall Design;
- Interim Surface Cover Grading Plan;
- Stormwater Management Plan;
- Groundwater and DNAPL Recovery Design
- Groundwater Treatment Plant Design;
- Lagoon Dewatering and Backfilling Plan;
- River Sediment and Ditch Soft Soil Removal Plan;
- Operation and Maintenance Plan;
- Construction Quality Assurance Plan;
- Construction Schedule; and,
- Technical Specifications.

Figure 7-2 is a Gantt chart representation of the anticipated IRA construction schedule. Assuming that the NJDEP reviews and approves this IRAW within a three month timeframe and the review of permit applications are performed in a timely fashion as assumed in the schedule, construction of the IRA can be completed by August 2010.

### **7.3 INTERIM RESPONSE ACTION PROGRESS REPORTS**

IRA progress reports will be submitted to the NJDEP on a quarterly basis in accordance with the requirements specified in N.J.A.C. 7:26E-6.6.

## **FIGURES**







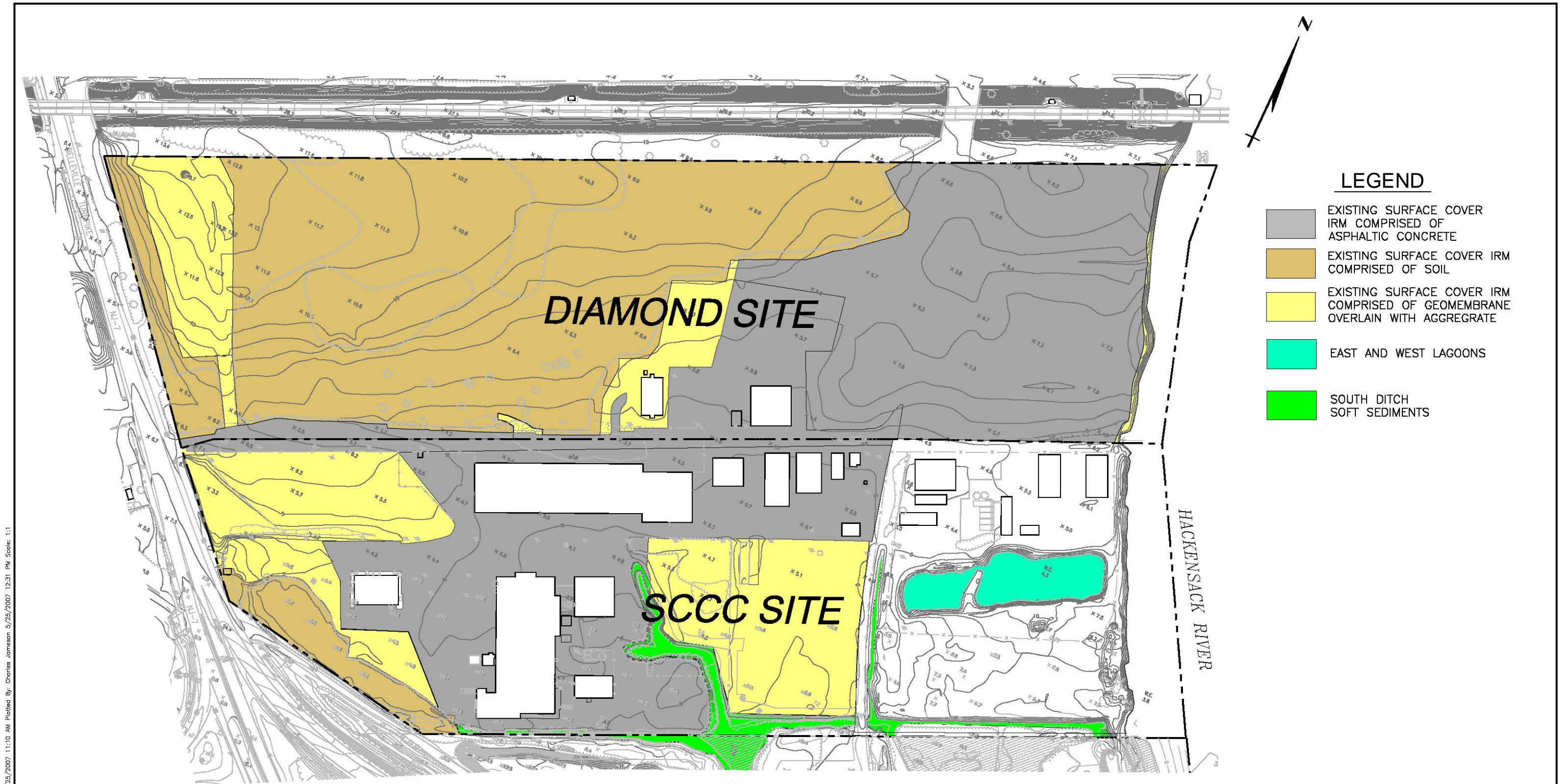
y:\kearny\07-417\kearny 2007\figure 1-2.dwg Last Saved By: Devens 5/25/2007 11:10 AM Plotted By: Charles Jamison 5/25/2007 12:31 PM Scale: 1:1

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REV #	DATE	DESCRIPTION	APPD

REFERENCE: 1. VERTICAL REFERENCE: NATIONAL GEODETIC VERTICAL DATUM (NGVD 1929).		

ISSUE DATE:
KEY ENVIRONMENTAL, INC. 200 THIRD AVENUE CARNEGIE, PA 15106

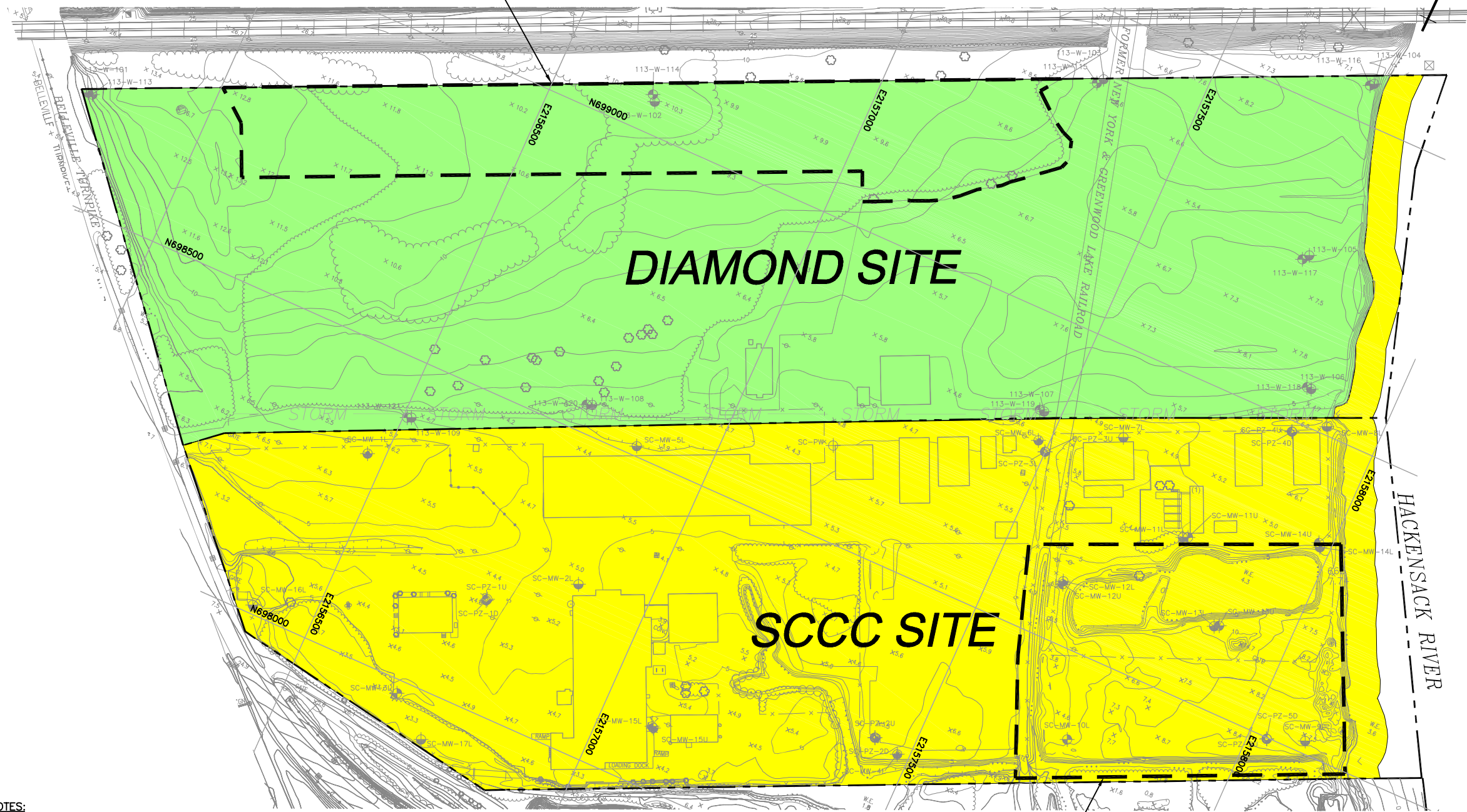
PENINSULA RESTORATION GROUP	
DRWN: GLC CHKD: AEB APPD: JSZ SCALE: AS SHOWN	DATE: 5-3-07 DATE: 5-3-07 DATE: 5-3-07
INTERIM RESPONSE ACTION WORKPLAN SCCC AND DIAMOND SITES KEARNY, NEW JERSEY	
GENERAL SITE ARRANGEMENT AND SURFACE COVER IRM AREAS	PROJECT NO: 07-417 FIGURE 1-2







DIAMOND SITE IRA  
CONSOLIDATION AREA<sup>(4)</sup>



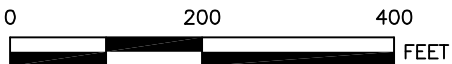
LEGEND

- PROPERTY BOUNDARY
- EXISTING ACCESS ROAD
- EXISTING FENCE
- EXISTING STRUCTURES
- EXISTING GROUND SURFACE ELEVATION CONTOURS
- EXISTING STREAM, POND AND RIVER BANK
- EXISTING VEGETATION
- EXISTING UTILITY POLES
- EXISTING RAILROAD LINE (ACTIVE)
- EXISTING FILL UNIT MONITORING WELL LOCATION
- EXISTING SAND UNIT MONITORING WELL LOCATION
- EXISTING PIEZOMETER LOCATION
- ABANDONED PRODUCTION WELL LOCATION
- PROPOSED SCCC SITE AREA OF CONTAMINATION (AOC)
- PROPOSED DIAMOND SITE AREA OF CONTAMINATION (AOC)
- PROPOSED LIMITS OF CONSOLIDATION AREA

- NOTES:
- USE OF AREA OF CONTAMINATION (AOC) POLICY CONTINGENT UPON USEPA CONCURRENCE WITH THE USE OF THE POLICY. THE AOCs WILL BE USED IF CONCURRENCE WITH USE OF THE POLICY IS RECEIVED ANY TIME PRIOR TO ACTUAL IMPLEMENTATION OF AN IRA COMPONENT.
  - PROPOSED CONSOLIDATION AREAS WITHIN EACH AOC ARE DEPICTED ON FIGURE 3-7.
  - SUBJECT TO APPROVAL, ALL DIAMOND SITE AOC MATERIALS TO REMAIN IN THE DIAMOND SITE AOC, ALL SCCC SITE AOC MATERIALS (INCLUDING ALL RIVER SEDIMENTS) TO REMAIN IN THE SCCC SITE AOC.
  - DIAMOND SITE CONSOLIDATION AREA AND COVER SYSTEM TO BE USED ONLY IF SLURRY WALL SPOILS ARE PLACED IN THIS AREA CONTINGENT UPON AOC POLICY DETERMINATION OR WASTE CLASSIFICATION.

REFERENCE: 1. HORIZONTAL REFERENCE: NEW JERSEY STATE PLAN COORDINATES (NAD 1927).  
2. VERTICAL REFERENCE: NATIONAL GEODETIC VERTICAL DATUM (NGVD 1929).

SCCC SITE IRA  
CONSOLIDATION AREA



PENINSULA RESTORATION GROUP

DRWN: GLC	DATE: 5-07-07	<b>KEY ENVIRONMENTAL</b> <b>INCORPORATED</b>
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APPD: JSZ	DATE: 5-07-07	
SCALE:	AS SHOWN	

INTERIM RESPONSE ACTION WORKPLAN  
SCCC AND DIAMOND SITES  
KEARNY, NEW JERSEY

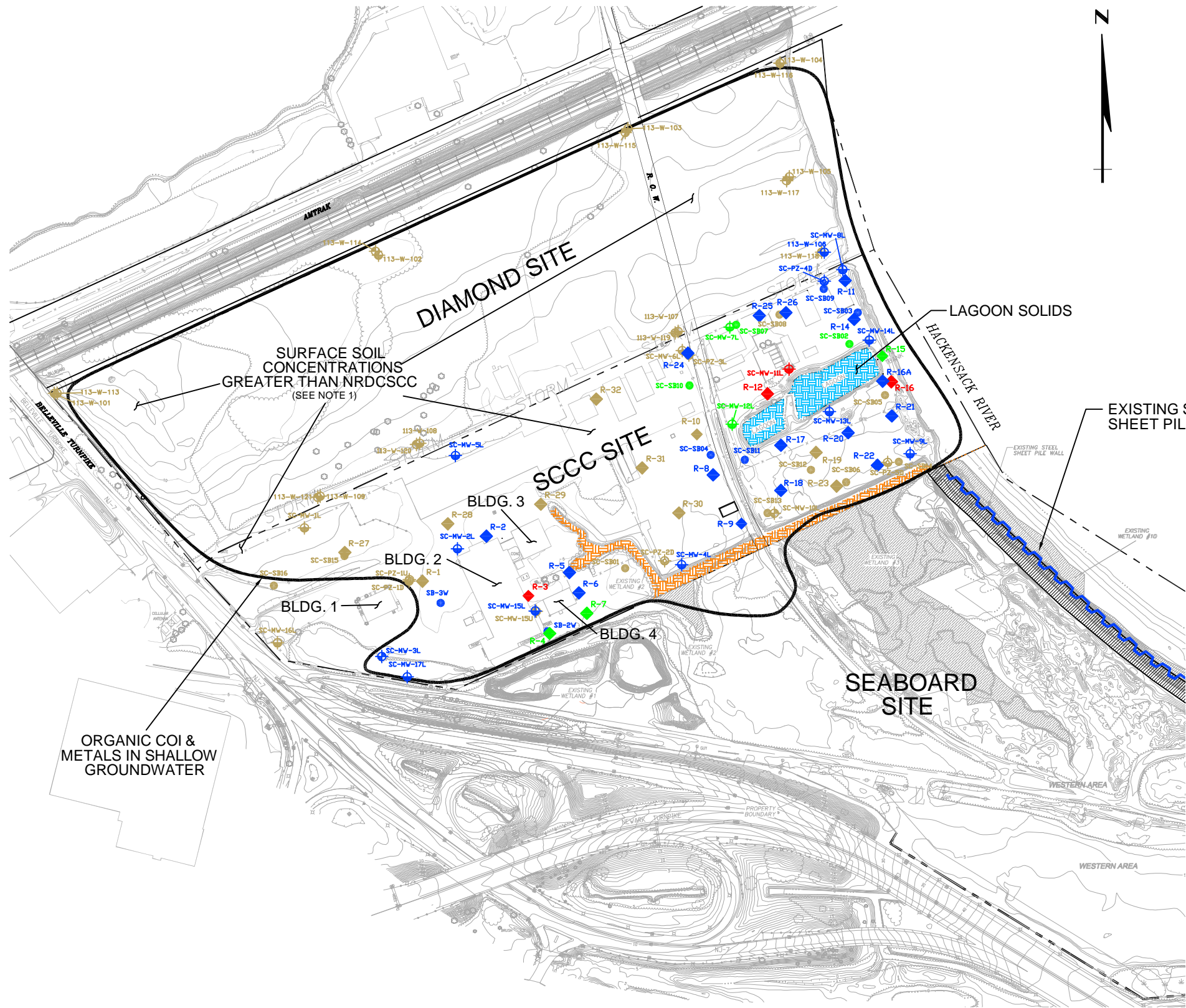
PROPOSED AREAS OF CONTAMINATION

PROJECT NO: 07-417  
FIGURE 1-4

ISSUE DATE:  
  
KEY ENVIRONMENTAL, INC.  
200 THIRD AVENUE  
CARNEGIE, PA 15106

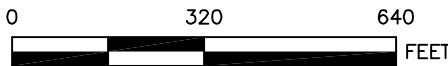


y:\keem\07-417\keem\2007\figure 2-1.dwg Last Saved By: Coleis 5/22/2007 2:59 PM Plotted By: Charles Jameson 5/25/2007 12:31 PM Scale: 1:1



# LEGEND

- EXISTING CONCRETE PAD
- EXISTING GROUND SURFACE ELEVATION CONTOURS
- EXISTING VEGETATION
- EXISTING STREAM, POND AND RIVER BANK
- EXISTING ELEVATION (FEET-MSL)
- EXISTING STEEL SHEET PILE WALL LOCATION
- PROPERTY BOUNDARY
- EXISTING ACCESS ROAD
- EXISTING RAILROAD LINE (ACTIVE)
- EXISTING FENCE
- EXISTING STRUCTURES
- EXISTING UTILITY POLES
- EXISTING LIGHT STANDARD
- EXISTING OVERHEAD POWER LINE
- SAND UNIT MONITORING WELL
- FILL UNIT MONITORING WELL
- SOIL BORING LOCATION
- FILL UNIT PIEZOMETER
- LOWER AQUIFER PIEZOMETER
- ROST BORING LOCATION
- EXISTING PROCESSED DREDGE MATERIAL (PDM) KEY
- LAGOON SOLIDS
- DITCH SEDIMENT
- DNAPL PRESENCE DETECTED IN SHALLOW FILL UNIT
- DNAPL PRESENCE DETECTED IN DEEPER SAND UNIT
- DNAPL PRESENCE DETECTED IN SHALLOW FILL AND DEEPER SAND UNITS
- DNAPL PRESENCE NOT DETECTED



## NOTES:

- SEVERAL INTERIM REMEDIAL MEASURES (SURFACE COVERS) HAVE BEEN COMPLETED AT THE DIAMOND AND SCCC SITES AS SHOWN ON FIGURE 2-3 FOR THE DIAMOND SITE AND FIGURE 2-10 FOR THE SCCC SITE.

REFERENCE: 1. VERTICAL REFERENCE: NATIONAL GEODETIC VERTICAL DATUM (NGVD 1929).

ISSUE DATE:

KEY ENVIRONMENTAL, INC.  
200 THIRD AVENUE  
CARNEGIE, PA 15106

PENINSULA RESTORATION GROUP

DRWN: GLC  
CHKD: RJH  
APPD: JSZ  
SCALE: AS SHOWN

DATE: 5-09-07  
DATE: 5-09-07  
DATE: 5-09-07



INTERIM RESPONSE ACTION WORKPLAN  
SCCC AND DIAMOND SITES  
KEARNY, NEW JERSEY

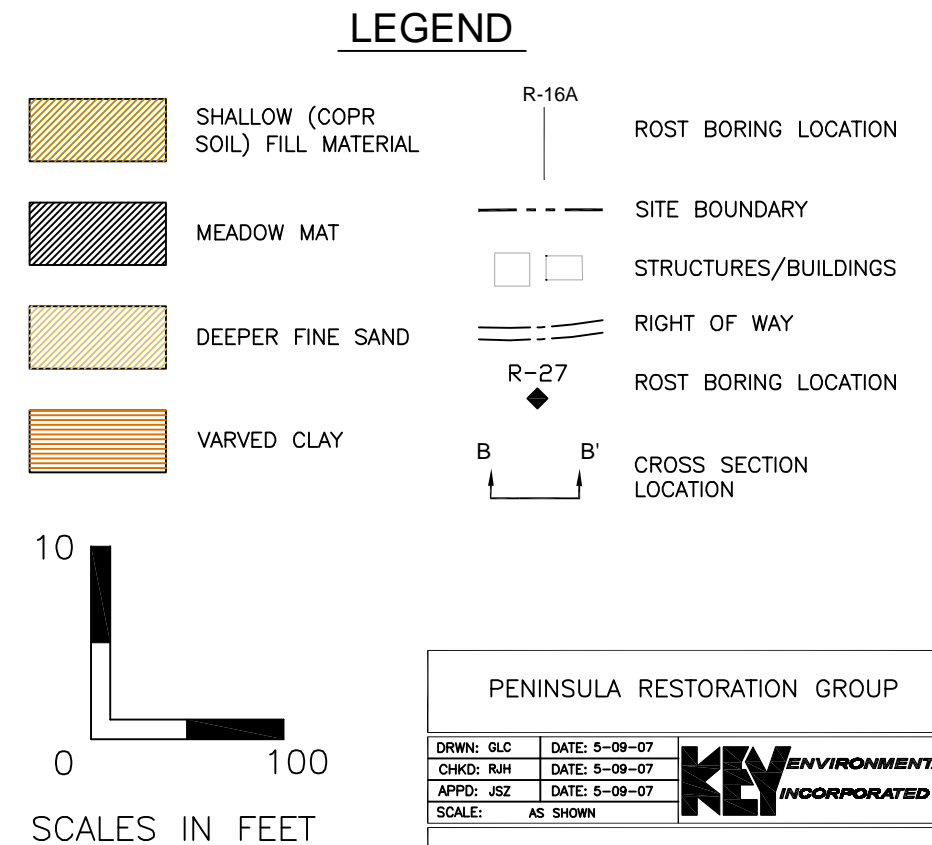
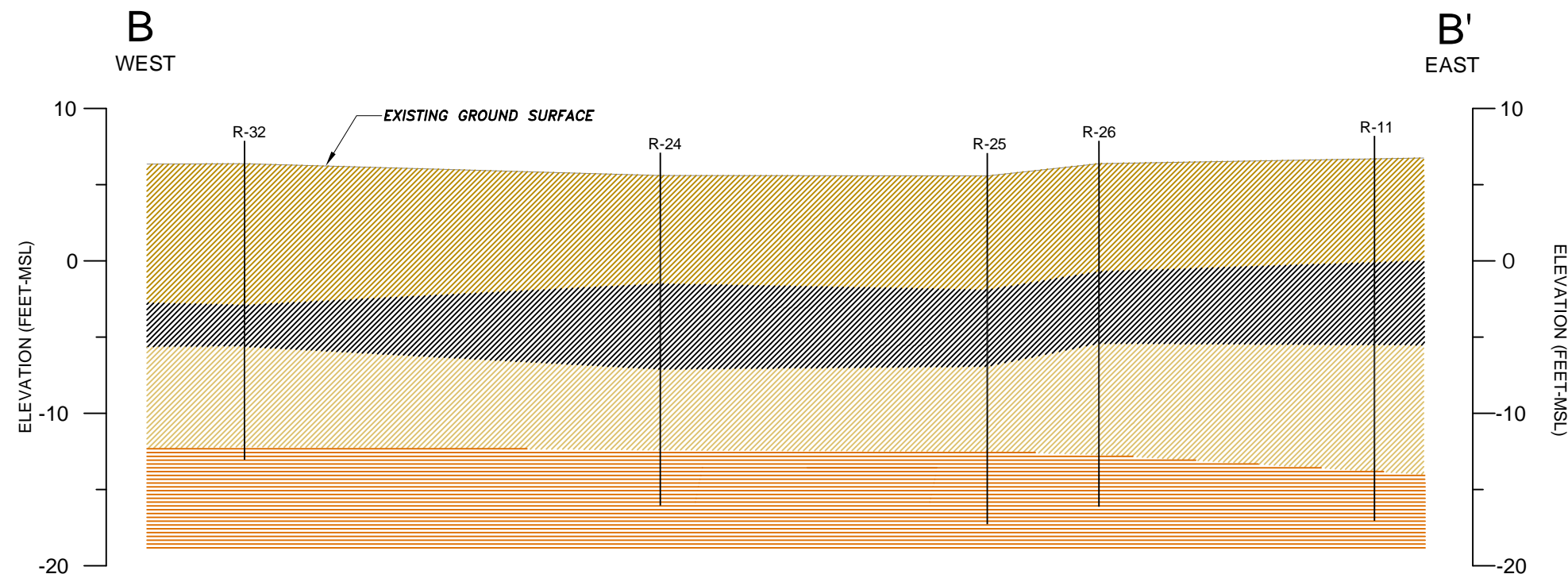
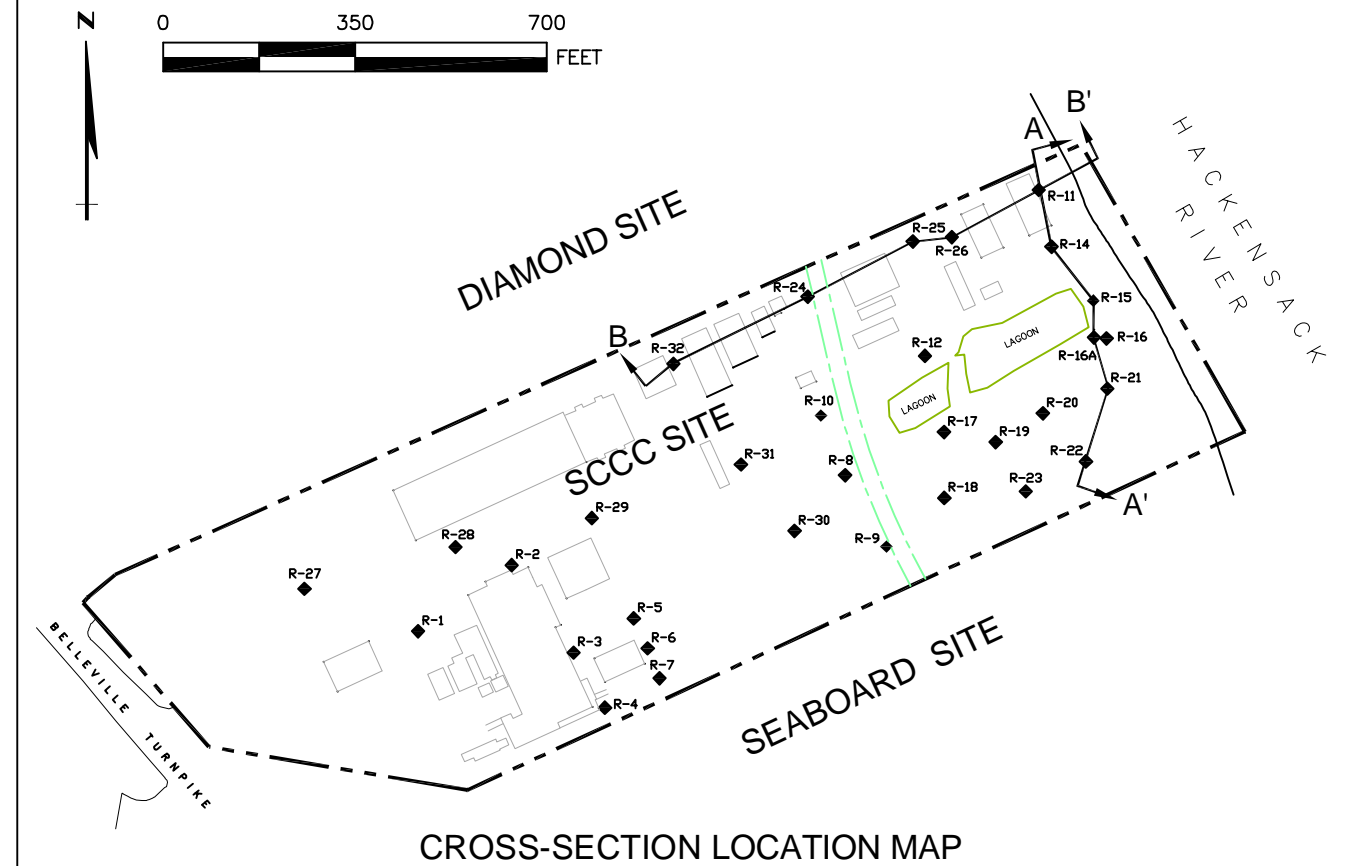
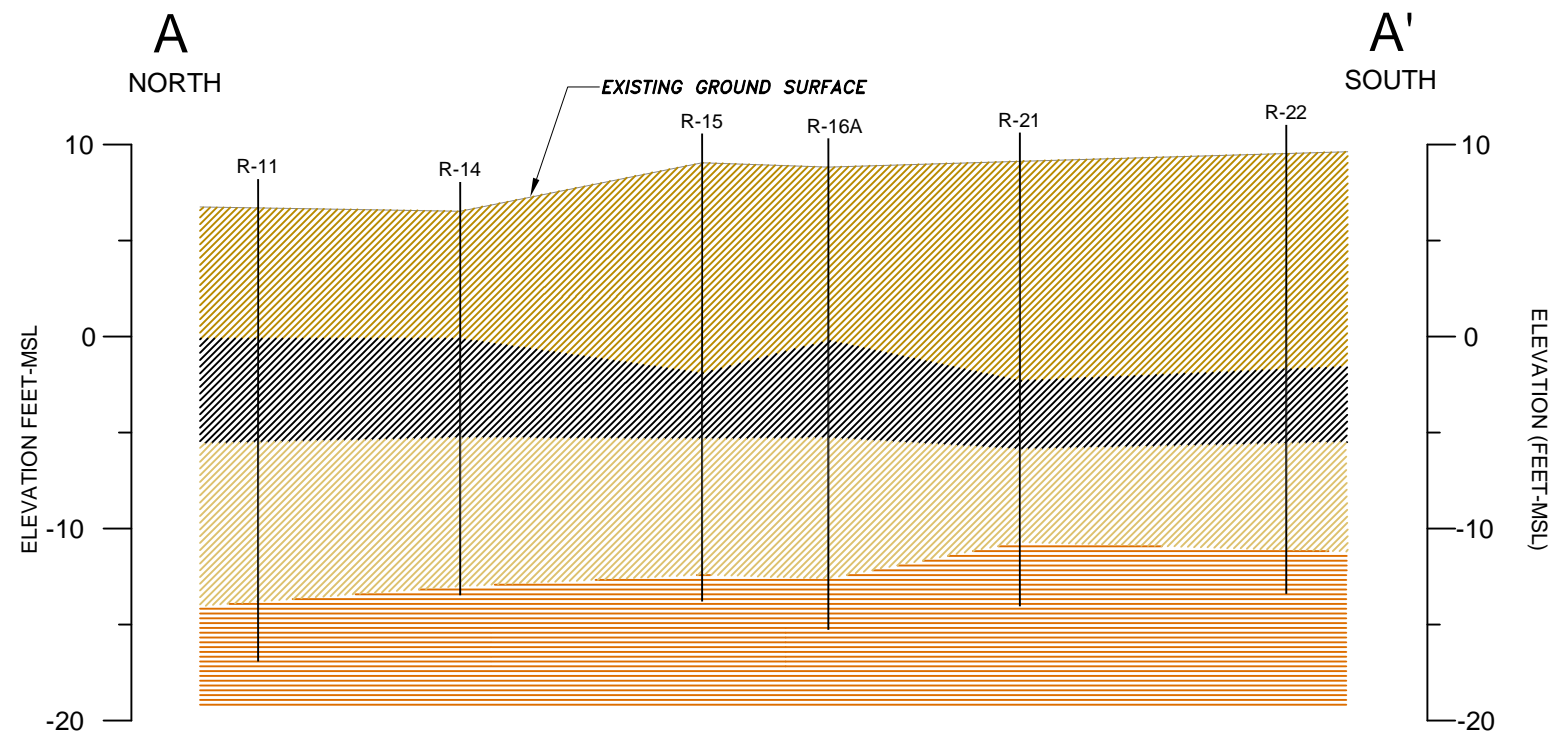
SUMMARY OF ENVIRONMENTAL  
CONDITIONS

PROJECT NO: 07-417  
FIGURE 2-1

REV #	DATE	DESCRIPTION	APPD



y:\kearny\07-417\kearny 2007\figure 2-2.dwg Last Saved By: Goleis 5/22/2007 3:05 PM Plotted By: Charles Jameson 5/25/2007 12:32 PM Scale: 1:1



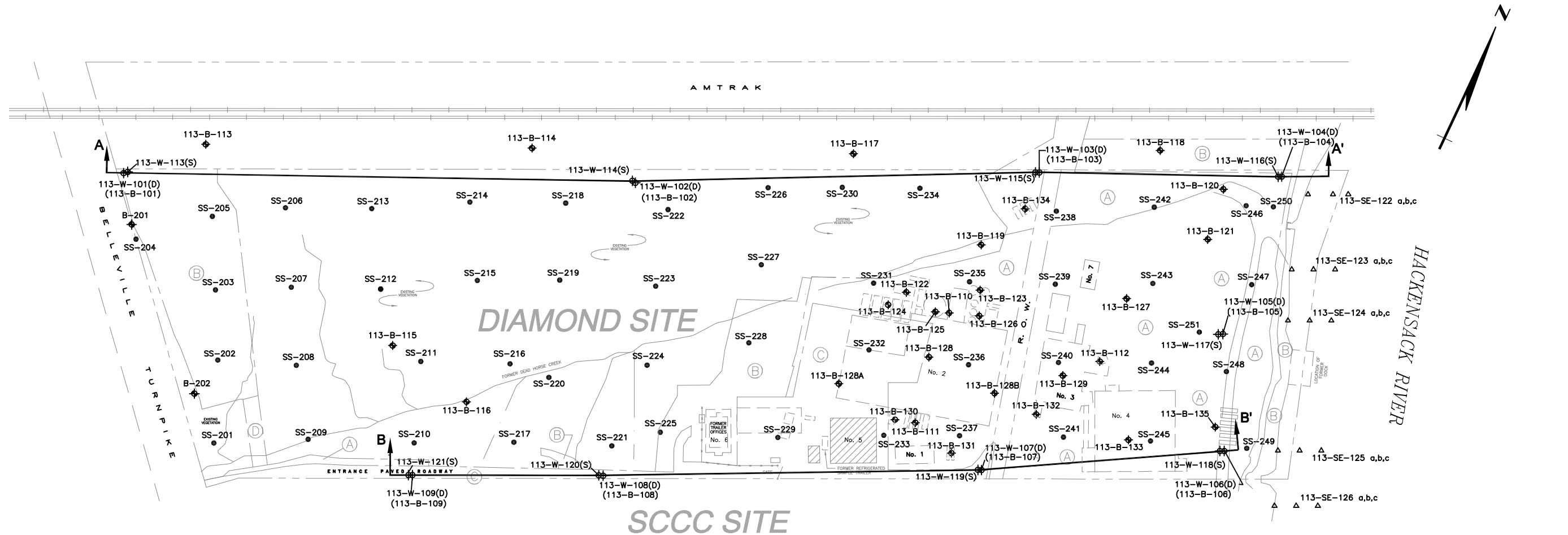
REFERENCE: 1. STANDARD CHLORINE CHEMICAL COMPANY SITE SURVEY, NEGLIA ENGINEERING ASSOCIATES, JANUARY 1999. ADDITIONAL BUILDING LOCATIONS OBTAINED FROM ERM, INC. FIGURES 1, 3-1, 3-2, 3-3 AND 3-4, PROPOSED REMEDIAL ACTION PLAN, STANDARD CHLORINE SITE, KEARNY NEW JERSEY.

2. VERTICAL REFERENCE: NATIONAL GEODETIC VERTICAL DATUM (NGVD 1929).

ISSUE DATE:

KEY ENVIRONMENTAL, INC.  
200 THIRD AVENUE  
CARNEGIE, PA 15106

y:\kearny\07-417\kearny 2007\figure 2-3.dwg Last Saved By: Goleis 5/23/2007 10:03 AM Plotted By: Charles Jameson 5/25/2007 12:32 PM Scale: 1:1



## LEGEND

- MONITORING WELL
- DELINERATION SOIL BORING LOCATION  
PREFIX NUMBER DESIGNATES SITE NO.
- GEOPROBE® DELINERATION SOIL BORING LOCATION
- SS-207
- SURFACE SOIL SAMPLE LOCATION (0' TO 0.5')
- SURFACE SAMPLE
- a= COLLECTED AT SURFACE, ON SHORE EDGE  
b= COLLECTED 40' OFFSHORE  
TOTAL WATER DEPTH 15'  
c= COLLECTED 80' OFFSHORE  
TOTAL WATER DEPTH 25'

- (S) SHALLOW FILL UNIT WELL  
(D) DEEP SAND UNIT WELL
- GEOLOGIC CROSS-SECTION ORIENTATION  
(SEE FIGURES 2-4 AND 2-5)
- UTILITY POLE
- PROPERTY LINE
- FENCE LINE
- EDGE OF ASPHALT

- EXISTING STRUCTURE
- APPROXIMATE LOCATION OF FORMER  
STRUCTURE/ABOVE AND BELOW GROUND TANK
- IRM BOUNDARY
- 4" BITUMINOUS ASPHALT PAVEMENT OVER  
4" DENSE GRADED AGGREGATE AND  
GEOTEXTILE FABRIC OVER EXISTING SOILS
- GEOTEXTILE FABRIC/GEOMEMBRANE LINER  
COMPOSITE AND 4" DENSE GRADED  
AGGREGATE OVER EXISTING SOILS
- 2" ASPHALT OVER EXISTING PAVEMENT
- 4" DENSE GRADED AGGREGATE OVER GEOTEXTILE  
FABRIC/GEOMEMBRANE LINER COMPOSITE OVER  
6"-12" OF 1.5" STONE

- BUILDINGS
- No. 1 - OFFICES  
No. 2 - BOILERS, CRYSTAL OPERATIONS,  
SHIPPING & RECEIVING  
No. 3 - MILLING OPERATIONS  
No. 4 - CHARGING KILNS  
No. 5 - MAINTENANCE BUILDING  
No. 6 - OFFICES  
No. 7 - CLOTH BAG STORAGE

0 200 400  
FEET

PENINSULA RESTORATION GROUP

DRWN: GLC	DATE: 5-09-07	<b>KEY ENVIRONMENTAL</b> <b>INCORPORATED</b>
CHKD: RJH	DATE: 5-09-07	
APPD: JSZ	DATE: 5-09-07	
SCALE: AS SHOWN		

INTERIM RESPONSE ACTION WORKPLAN  
SCCC AND DIAMOND SITES  
KEARNY, NEW JERSEY

DIAMOND SITE GEOLOGIC  
CROSS-SECTION LOCATIONS

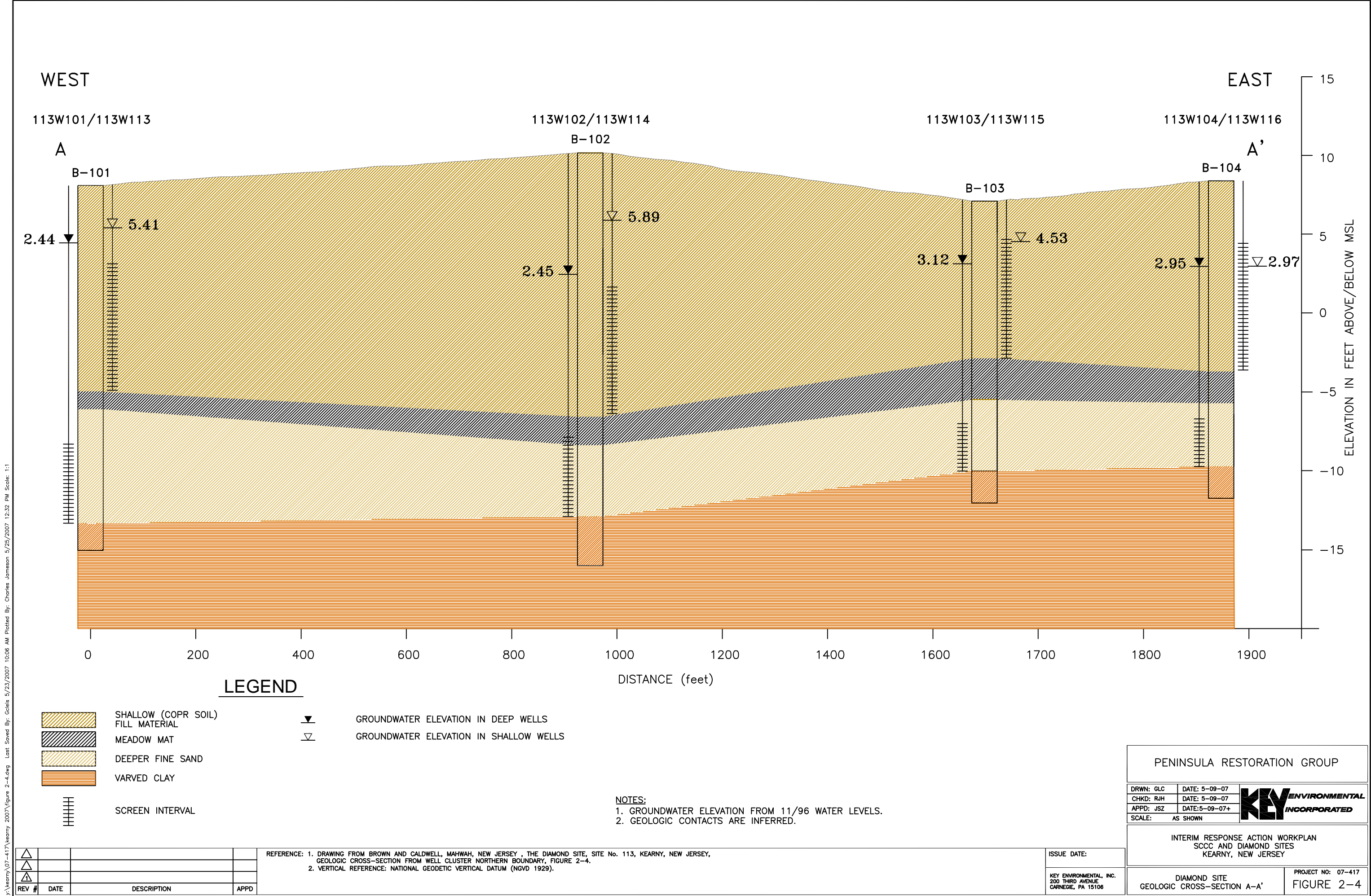
PROJECT NO: 07-417  
FIGURE 2-3

ISSUE DATE:

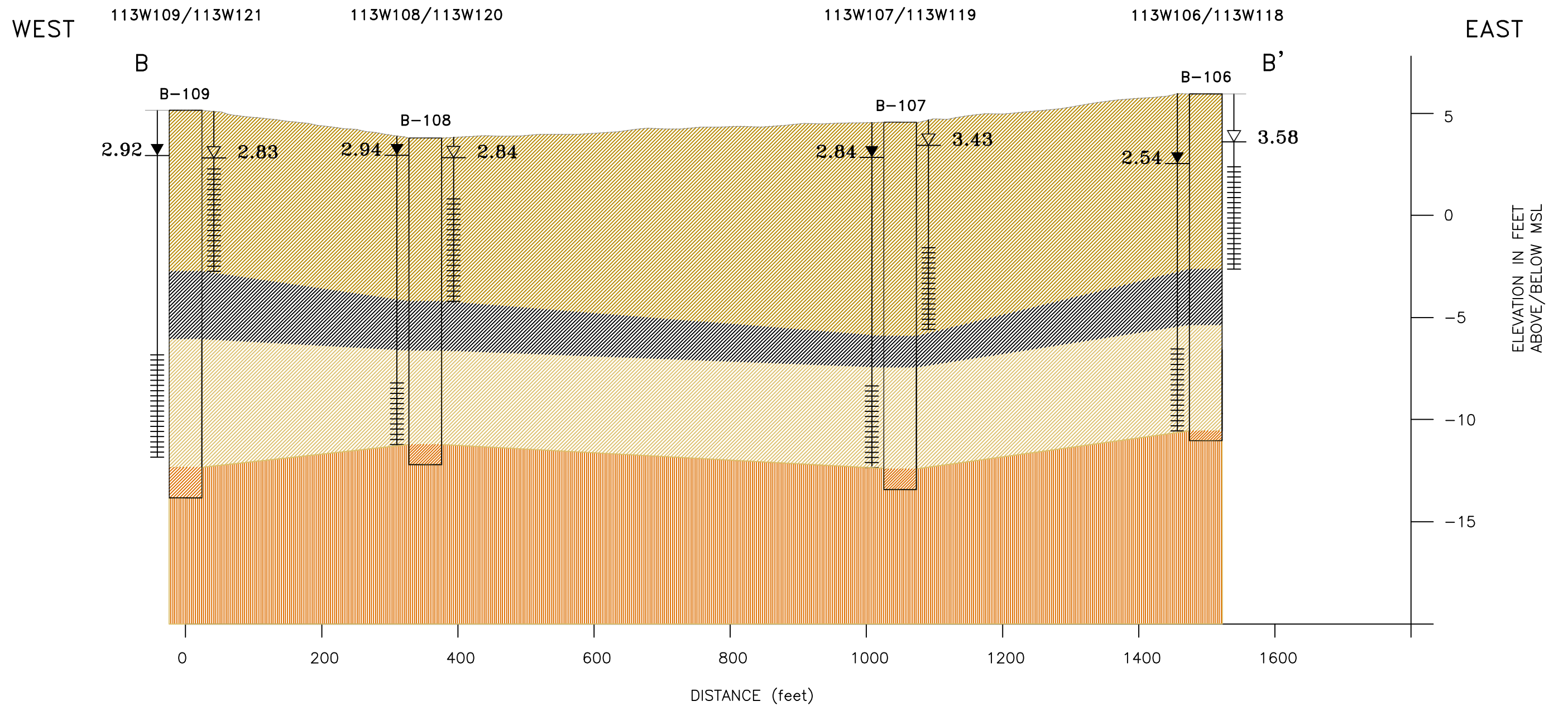
KEY ENVIRONMENTAL, INC.  
200 THIRD AVENUE  
CARNEGIE, PA 15106

REFERENCE: 1. DRAWING FROM BROWN AND CALDWELL, MAHWAH, NEW JERSEY, THE DIAMOND SITE, SITE NO. 113, KEARNY, NEW JERSEY, RI SAMPLE LOCATION PLAN, FIGURE 113-01.  
2. VERTICAL REFERENCE: NATIONAL GEODETIC VERTICAL DATUM (NGVD 1929).

REV #	DATE	DESCRIPTION	APPD



y:\kearny\07-417\kearny 2007\figure 2-5.dwg Last Saved By: Goleis 5/23/2007 9:47 AM Plotted By: Charles Jameson 5/25/2007 12:32 PM Scale: 1:1



## LEGEND

	SHALLOW (COPR SOIL) FILL MATERIAL		GROUNDWATER ELEVATION IN DEEP WELLS
	MEADOW MAT		GROUNDWATER ELEVATION IN SHALLOW WELLS
	DEEPER FINE SAND		
	VARVED CLAY		
	SCREEN INTERVAL		

## NOTES:

1. GROUNDWATER ELEVATION FROM 11/96 WATER LEVELS.
2. GEOLOGIC CONTACTS ARE INFERRED.

REV #	DATE	DESCRIPTION	APPD

REFERENCE: 1. DRAWING FROM BROWN AND CALDWELL, MAHWAH, NEW JERSEY , THE DIMOND SITE, SITE No. 113, KEARNY, NEW JERSEY, GEOLOGIC CROSS-SECTION FROM WELL CLUSTERSOUTHERNN BOUNDARY, FIGURE 2-5.  
2. VERTICAL REFERENCE: NATIONAL GEODETIC VERTICAL DATUM (NGVD 1929).

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KEY ENVIRONMENTAL, INC.  
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CARNEGIE, PA 15106

PENINSULA RESTORATION GROUP

DRWN: GLC	DATE: 5-09-07
CHKD: RJH	DATE: 5-09-07
APPD: JSZ	DATE: 5-09-07
SCALE:	AS SHOWN



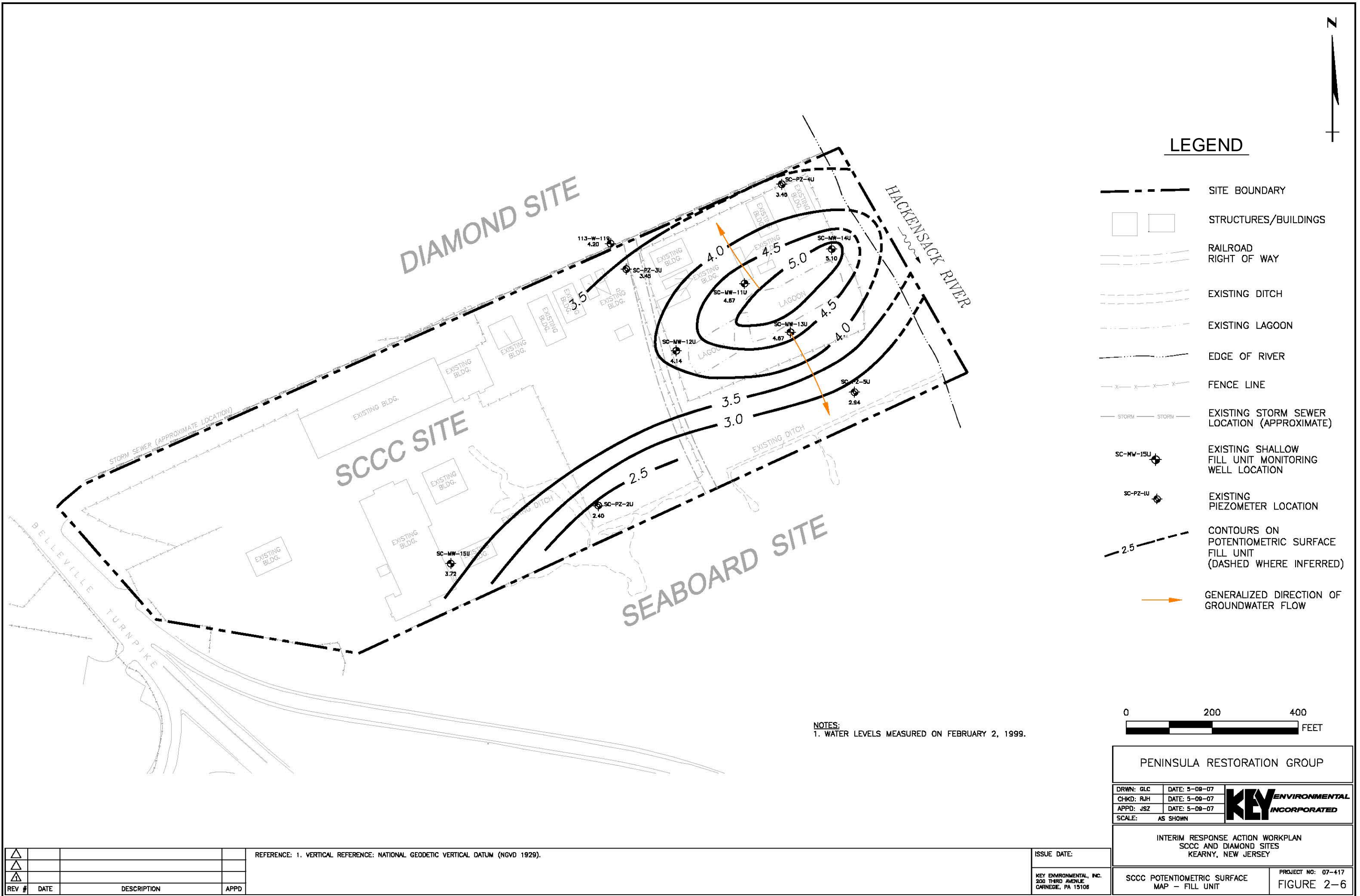
INTERIM RESPONSE ACTION WORKPLAN  
SCCC AND DIAMOND SITES  
KEARNY, NEW JERSEY

DIAMOND SITE  
GEOLOGIC CROSS-SECTION B-B'

PROJECT NO: 07-417  
FIGURE 2-5



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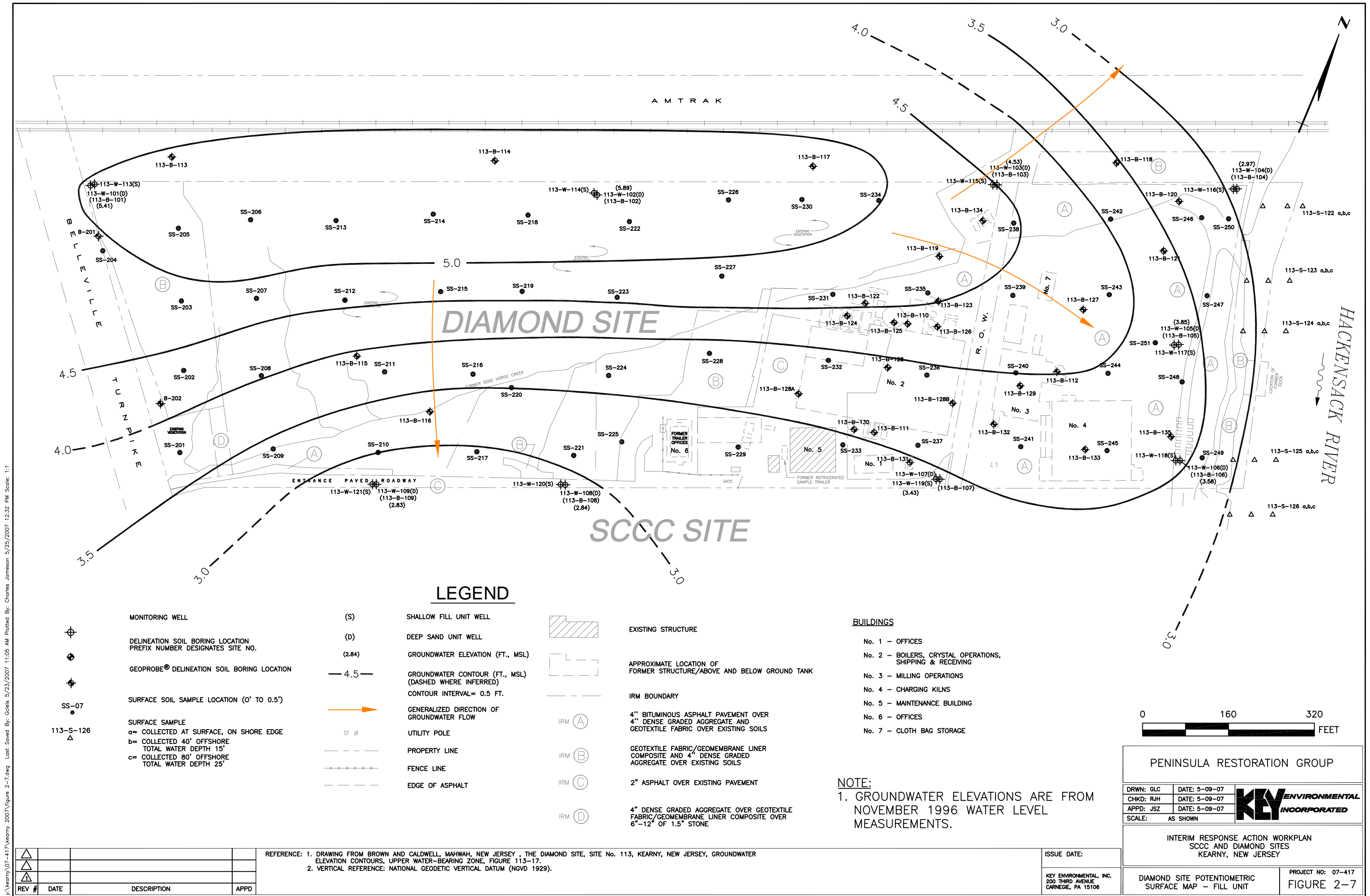


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REV #	DATE	DESCRIPTION	APPD

REFERENCE: 1. VERTICAL REFERENCE: NATIONAL GEODETIC VERTICAL DATUM (NGVD 1929).			

ISSUE DATE:	
KEY ENVIRONMENTAL, INC. 200 THIRD AVENUE CARNEGIE, PA 15106	
PROJECT NO: 07-417 SCCC POTENTIOMETRIC SURFACE MAP - FILL UNIT FIGURE 2-6	

y:\Kearny\07-417\Kearny, 2007\Figure 2-7.dwg Last Saved By: Goleis 5/22/2007 11:05 AM Plotted By: Charles Jameson 5/25/2007 12:32 PM Scale: 1:1



LEGEND

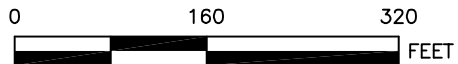
MONITORING WELL  
DELINEATION SOIL BORING LOCATION  
PREFIX NUMBER DESIGNATES SITE NO.  
GEOPROBE® DELINEATION SOIL BORING LOCATION  
SURFACE SOIL SAMPLE LOCATION (0' TO 0.5')  
SURFACE SAMPLE  
a= COLLECTED AT SURFACE, ON SHORE EDGE  
b= COLLECTED 40' OFFSHORE  
TOTAL WATER DEPTH 15'  
c= COLLECTED 80' OFFSHORE  
TOTAL WATER DEPTH 25'

(S) SHALLOW FILL UNIT WELL  
(D) DEEP SAND UNIT WELL  
(2.84) GROUNDWATER ELEVATION (FT., MSL)  
— 4.5 — GROUNDWATER CONTOUR (FT., MSL)  
(DASHED WHERE INFERRED)  
CONTOUR INTERVAL= 0.5 FT.  
—→— GENERALIZED DIRECTION OF  
GROUNDWATER FLOW  
UTILITY POLE  
PROPERTY LINE  
FENCE LINE  
EDGE OF ASPHALT

EXISTING STRUCTURE  
APPROXIMATE LOCATION OF  
FORMER STRUCTURE/ABOVE AND BELOW GROUND TANK  
IRM BOUNDARY  
4" BITUMINOUS ASPHALT PAVEMENT OVER  
4" DENSE GRADED AGGREGATE AND  
GEOTEXTILE FABRIC OVER EXISTING SOILS  
GEOTEXTILE FABRIC/GEOMEMBRANE LINER  
COMPOSITE AND 4" DENSE GRADED  
AGGREGATE OVER EXISTING SOILS  
2" ASPHALT OVER EXISTING PAVEMENT  
4" DENSE GRADED AGGREGATE OVER GEOTEXTILE  
FABRIC/GEOMEMBRANE LINER COMPOSITE OVER  
6"-12" OF 1.5" STONE

BUILDINGS  
No. 1 - OFFICES  
No. 2 - BOILERS, CRYSTAL OPERATIONS,  
SHIPPING & RECEIVING  
No. 3 - MILLING OPERATIONS  
No. 4 - CHARGING KILNS  
No. 5 - MAINTENANCE BUILDING  
No. 6 - OFFICES  
No. 7 - CLOTH BAG STORAGE

NOTE:  
1. GROUNDWATER ELEVATIONS ARE FROM  
NOVEMBER 1996 WATER LEVEL  
MEASUREMENTS.



PENINSULA RESTORATION GROUP

DRWN: GLC	DATE: 5-09-07	<b>KEY ENVIRONMENTAL</b> <b>INCORPORATED</b>
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APPD: JSZ	DATE: 5-09-07	
SCALE: AS SHOWN		

INTERIM RESPONSE ACTION WORKPLAN  
SCCC AND DIAMOND SITES  
KEARNY, NEW JERSEY

DIAMOND SITE POTENTIOMETRIC  
SURFACE MAP - FILL UNIT

PROJECT NO: 07-417  
FIGURE 2-7

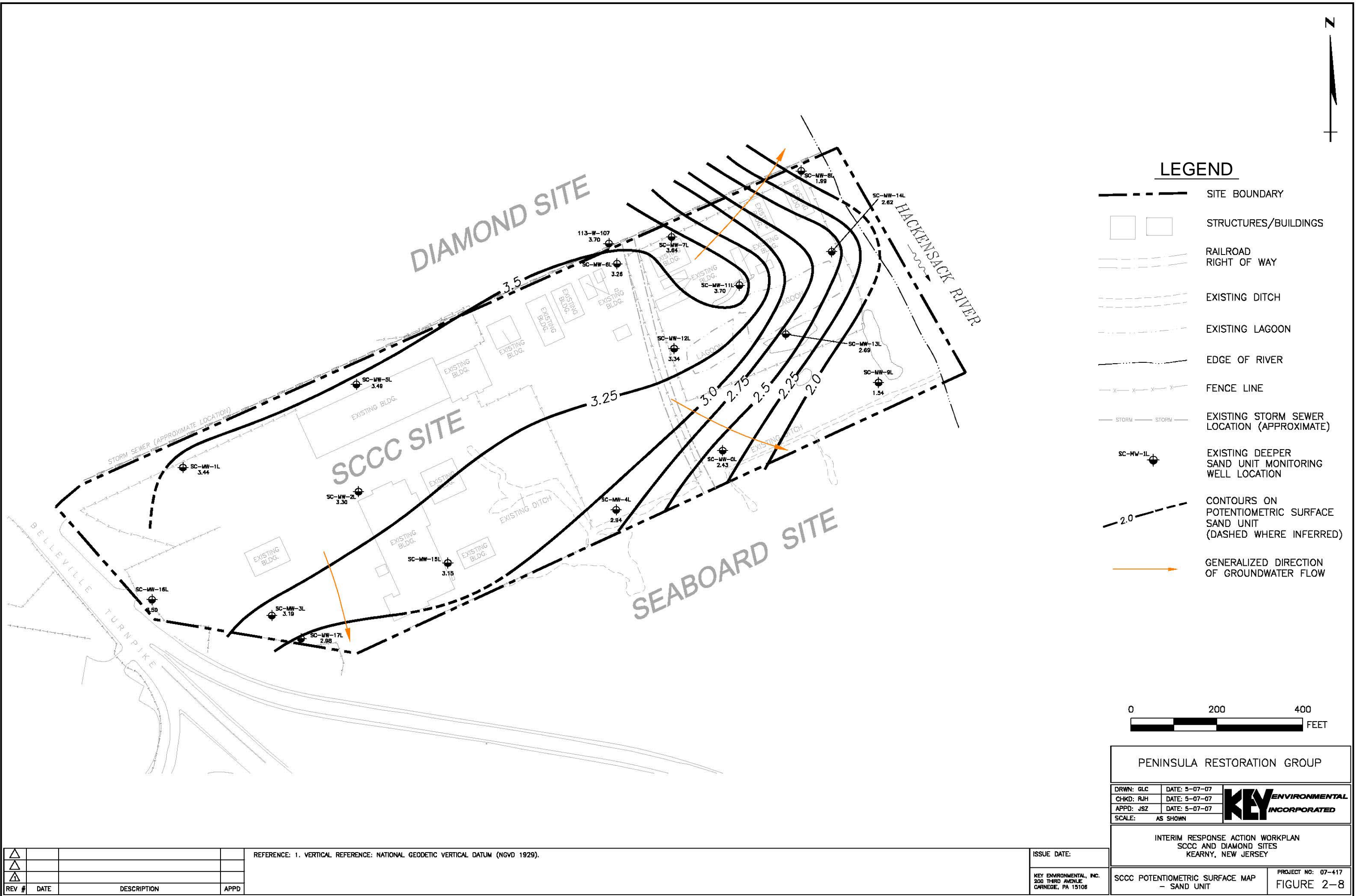
ISSUE DATE:  
KEY ENVIRONMENTAL, INC.  
200 THIRD AVENUE  
CARNEGIE, PA 15106

REFERENCE: 1. DRAWING FROM BROWN AND CALDWELL, MAHWAH, NEW JERSEY, THE DIAMOND SITE, SITE No. 113, KEARNY, NEW JERSEY, GROUNDWATER  
ELEVATION CONTOURS, UPPER WATER-BEARING ZONE, FIGURE 113-17.  
2. VERTICAL REFERENCE: NATIONAL GEODETIC VERTICAL DATUM (NGVD 1929).

REV #	DATE	DESCRIPTION	APPD



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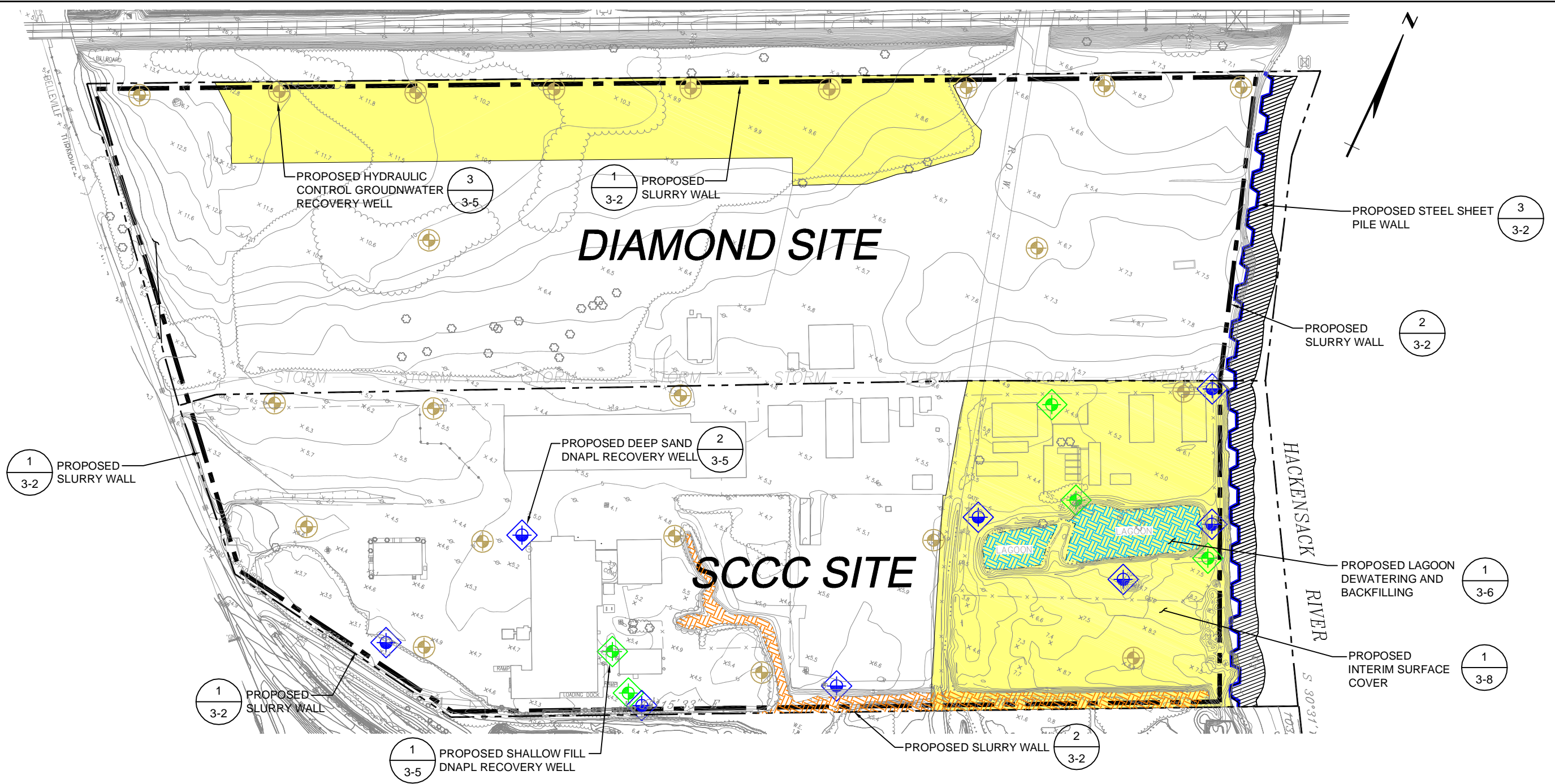








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### LEGEND

- |  |   |  |  |  |   |
|--|---|--|--|--|---|
|  | EXISTING ACCESS ROAD                          |  | EXISTING CONCRETE PAD                      |  | DETAIL NO.  |
|  | EXISTING NEW JERSEY TRANSIT RAILROAD (ACTIVE) |  | EXISTING GROUND SURFACE ELEVATION CONTOURS |  | FIGURE NO.  |
|  | EXISTING FENCE                                |  | EXISTING VEGETATION                        |  | UPPER (FILL UNIT) GROUNDWATER RECOVERY WELL LOCATION          |
|  | EXISTING STRUCTURES                           |  | EXISTING STREAM, POND AND RIVER BANK       |  | UPPER (FILL UNIT) DNAPL RECOVERY WELL LOCATION                |
|  | EXISTING UTILITY POLES                        |  | EXISTING ELEVATION (FEET-MSL)              |  | LOWER (DEEP SAND) DNAPL RECOVERY WELL LOCATION                |
|  | EXISTING LIGHT STANDARD                       |  | PROPOSED SLURRY WALL LOCATION              |  | PROPOSED LAGOON DEWATERING AND BACKFILLING                    |
|  | EXISTING OVERHEAD POWER LINE                  |  | PROPOSED STEEL SHEET PILE WALL LOCATION    |  | PROPOSED SEDIMENT REMOVAL                                     |
|  | PROPERTY BOUNDARY                             |  |  |  | PROPOSED DRAINAGE DITCH REMEDIATION (EXCAVATION AND BACKFILL) |
|  |   |  |  |  | PROPOSED INTERIM SURFACE COVER                                |

NOTES:  
ADDITIONAL IRA COMPONENTS INCLUDING HYDRAULIC CONTROL, STORMWATER MANAGEMENT, GRADING, AND SURFACE COVER PROVIDED ON FIGURES 3-3, 3-4, 3-7 AND 3-8.

0 200 400  
FEET

PENINSULA RESTORATION GROUP

DRWN: GLC	DATE: 5-07-07	
CHKD: RJH	DATE: 5-07-07	
APPD: JSZ	DATE: 5-07-07	
SCALE: AS SHOWN		

INTERIM RESPONSE ACTION WORKPLAN  
SCCC AND DIAMOND SITES  
KEARNY, NEW JERSEY

INTERIM RESPONSE ACTION PLAN

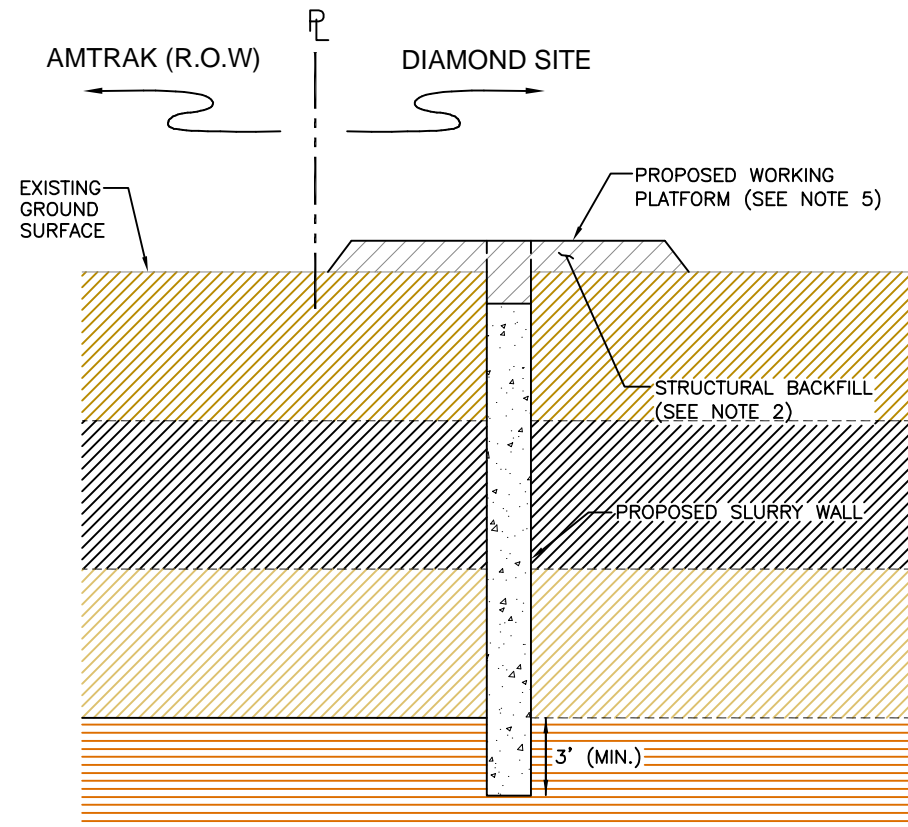
PROJECT NO: 07-417  
FIGURE 3-1

ISSUE DATE:

KEY ENVIRONMENTAL, INC.  
200 THIRD AVENUE  
CARNEGIE, PA 15106

REFERENCE: 1. VERTICAL REFERENCE: NATIONAL GEODETIC VERTICAL DATUM (NGVD 1929).

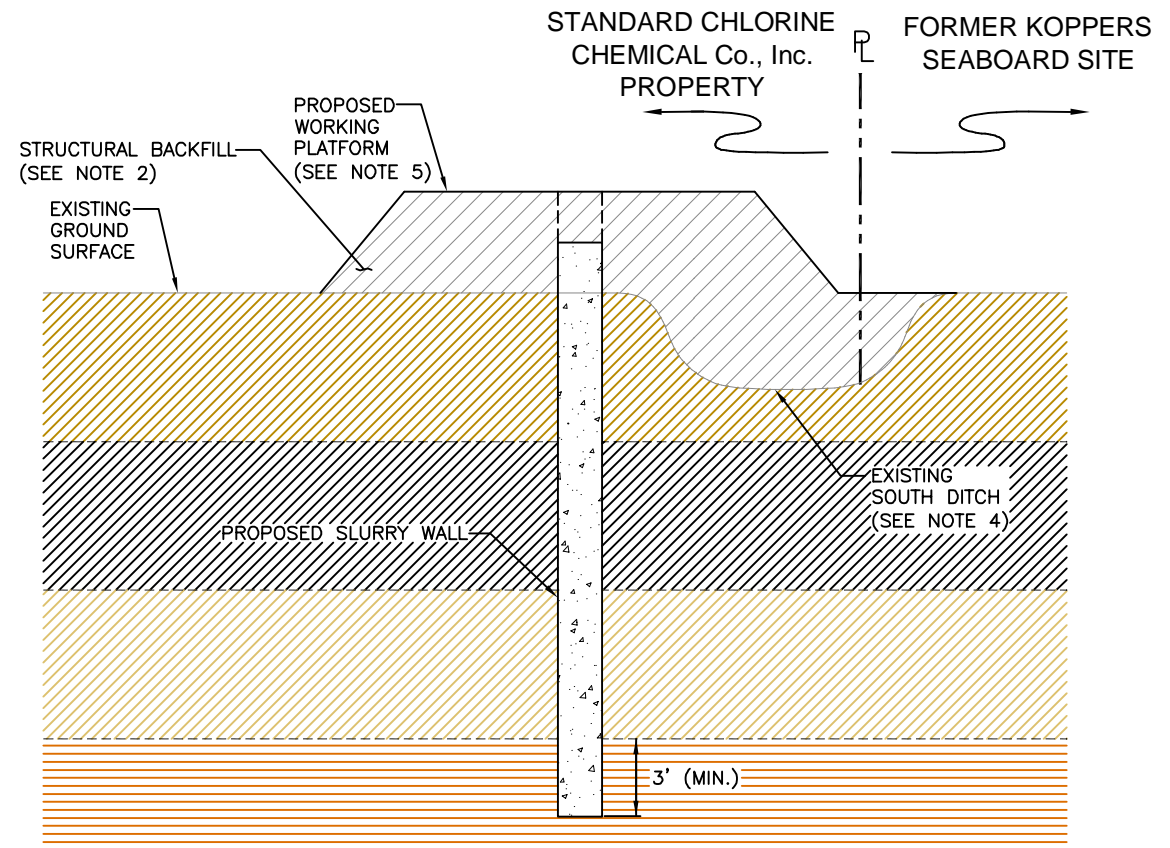
REV #	DATE	DESCRIPTION	APPD



TYPICAL BARRIER WALL SECTION  
NORTHERN AND WESTERN WALL

NOT TO SCALE

1  
3-2



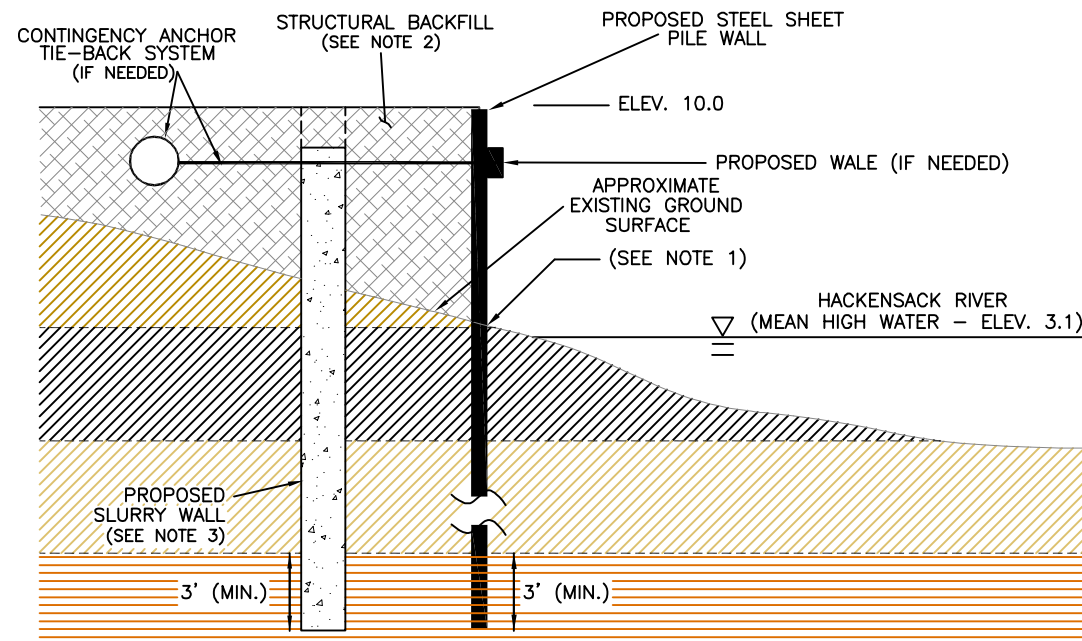
TYPICAL BARRIER WALL SECTION  
SOUTHERN WALL

NOT TO SCALE

2  
3-2

#### STEEL SHEET PILE WALL NOTES:

1. THE WALL WILL BE INSTALLED UPLAND OF THE MEAN HIGH WATER LINE. THE MEAN HIGH WATER LINE ELEVATION IS REPORTED TO BE 3.1 FEET MSL (NGVD 1929). THE MEAN HIGH WATER LINE ELEVATION WILL BE CONFIRMED AS PART OF THE DETAILED DESIGN.
2. STRUCTURAL BACKFILL WILL BE PLACED AS REQUIRED TO CONSTRUCT THE SLURRY WALL WORKING PLATFORM, AND TO SUPPORT THE ANCHOR TIE-BACK SYSTEM, IF NEEDED.
3. THE HORIZONTAL SEPARATION BETWEEN THE STEEL SHEET PILE WALL AND THE SLURRY WALL WILL BE THE MINIMUM DISTANCE NECESSARY TO FACILITATE CONSTRUCTION. THE TOP ELEVATION OF THE SLURRY WALL WILL BE AT LEAST ELEVATION 7.0 FEET MSL.
4. THE SOUTH DITCH IS LOCATED INSIDE THE PROPERTY LINE AT ITS EASTERN END. THE SOUTH DITCH STRADDLES THE PROPERTY LINE AT ITS WESTERN END. SEDIMENT WILL BE REMOVED AND THE DITCH BACKFILLED ALONG IT'S ENTIRE LENGTH TO PROVIDE SUBGRADE FOR WORKING PLATFORM, AS REQUIRED.
5. WORKING PLATFORM SHALL BE WIDENED AS REQUIRED TO PROVIDE FOR MIXING OF SOIL-BENTONITE BACKFILL ADJACENT TO THE SLURRY TRENCH, AT THE DISCRETION OF THE ENGINEER.



TYPICAL BARRIER WALL SECTION  
SECTION - RIVERSIDE WALL

NOT TO SCALE

3  
3-2

#### LEGEND

	FILL MATERIAL
	MEADOW MAT
	DEEPER FINE SAND
	VARVED CLAY

#### PENINSULA RESTORATION GROUP

DRWN: GLC	DATE: 5-07-07
CHKD: RJH	DATE: 5-07-07
APPD: JSZ	DATE: 5-07-07
SCALE:	AS SHOWN



INTERIM RESPONSE ACTION WORKPLAN  
SCCC AND DIAMOND SITES  
KEARNY, NEW JERSEY

BARRIER WALL DETAILS

PROJECT NO: 07-417  
FIGURE 3-2

REFERENCE: 1. VERTICAL REFERENCE: NATIONAL GEODETIC VERTICAL DATUM (NGVD 1929).

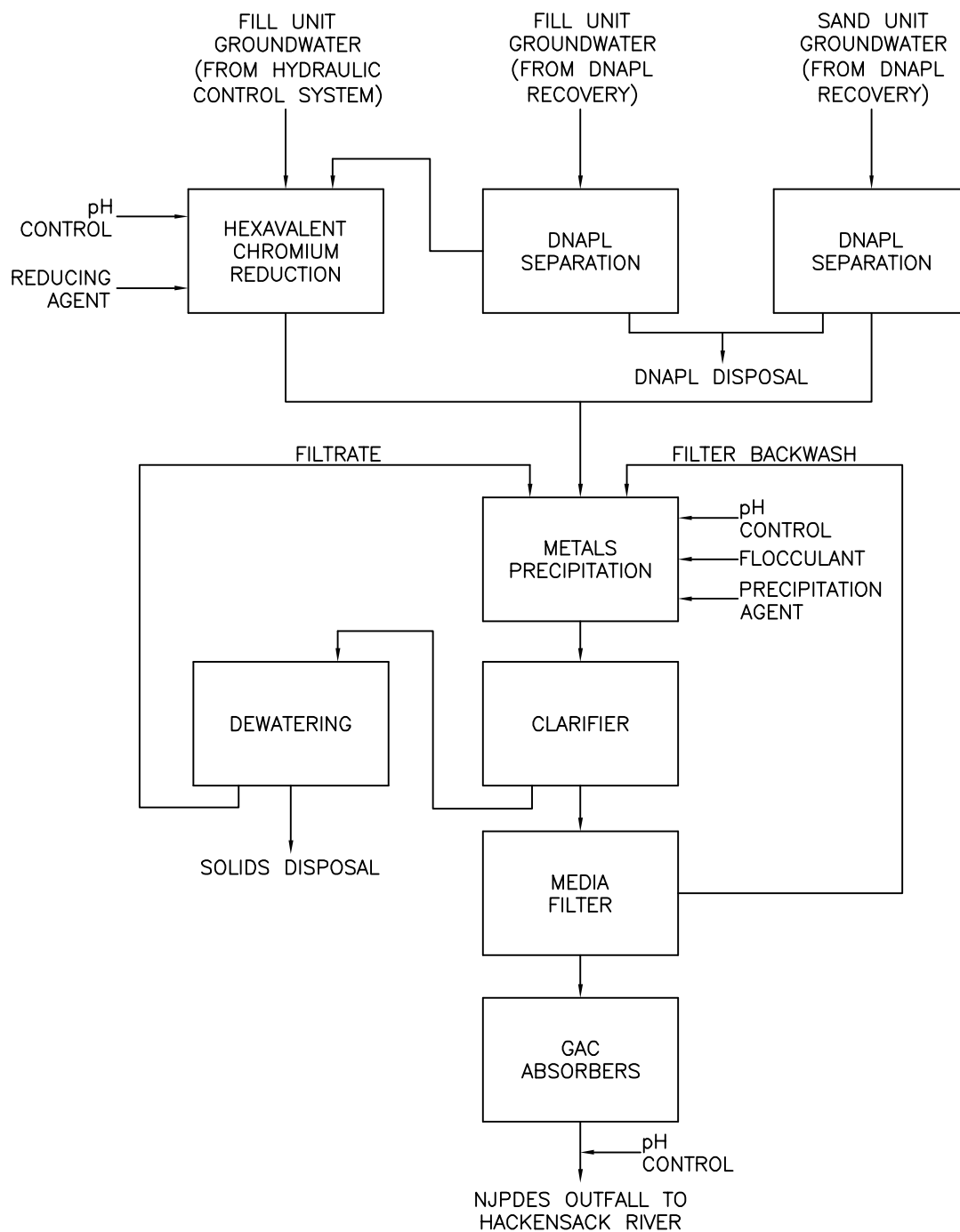
ISSUE DATE:

KEY ENVIRONMENTAL, INC.  
200 THIRD AVENUE  
CARNEGIE, PA 15106

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REV #	DATE	DESCRIPTION	APPD







## PROCESS FLOW DIAGRAM - GROUNDWATER TREATMENT

1

3-4

PENINSULA RESTORATION GROUP

DRWN: GLC	DATE: 5-3-07
CHKD: RJH	DATE: 5-3-07
APPD: JSZ	DATE: 5-3-07
SCALE: AS SHOWN	

**KEY** ENVIRONMENTAL  
INCORPORATED

INTERIM RESPONSE ACTION WORKPLAN  
SCCC AND DIAMOND SITES  
KEARNY, NEW JERSEY

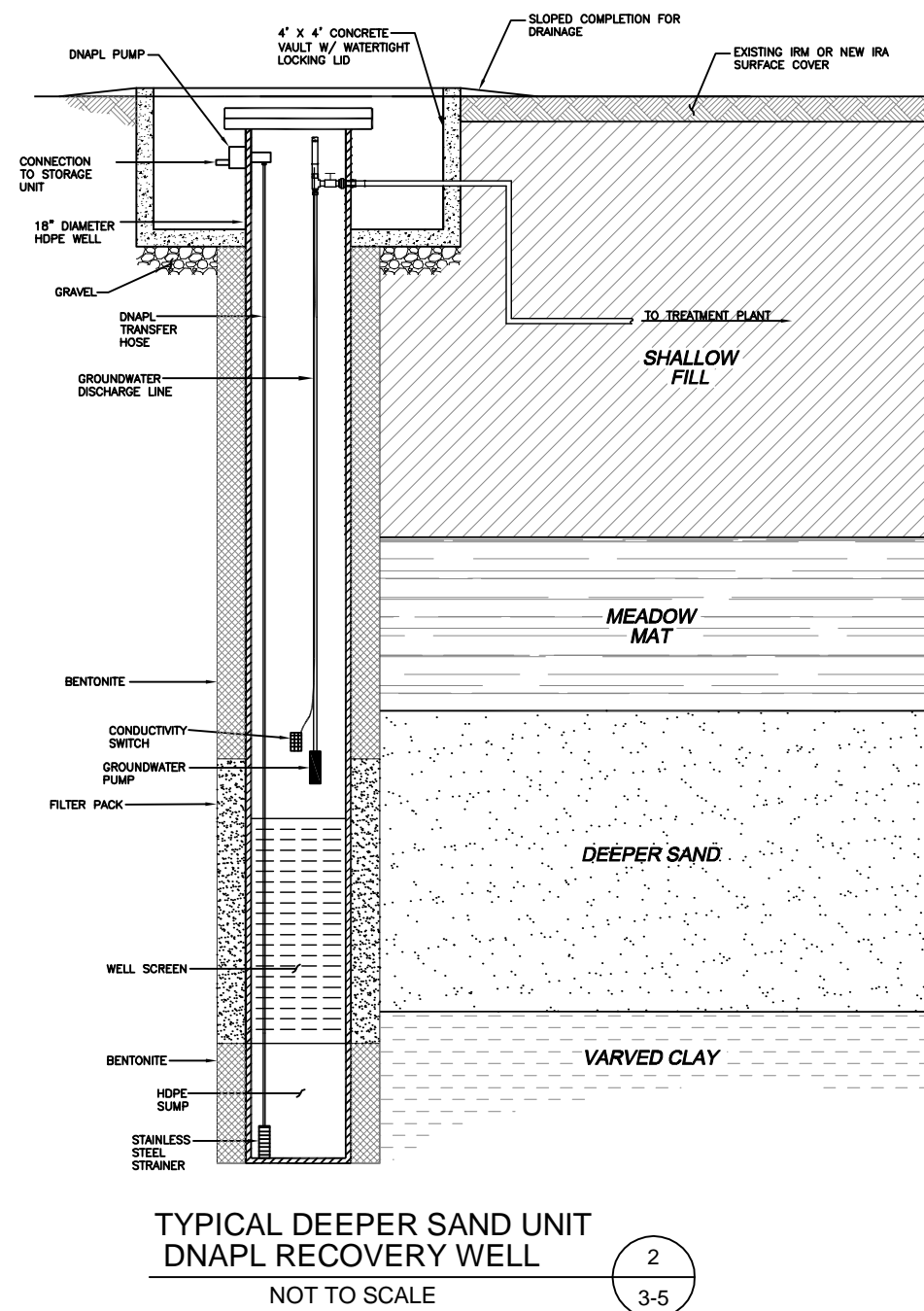
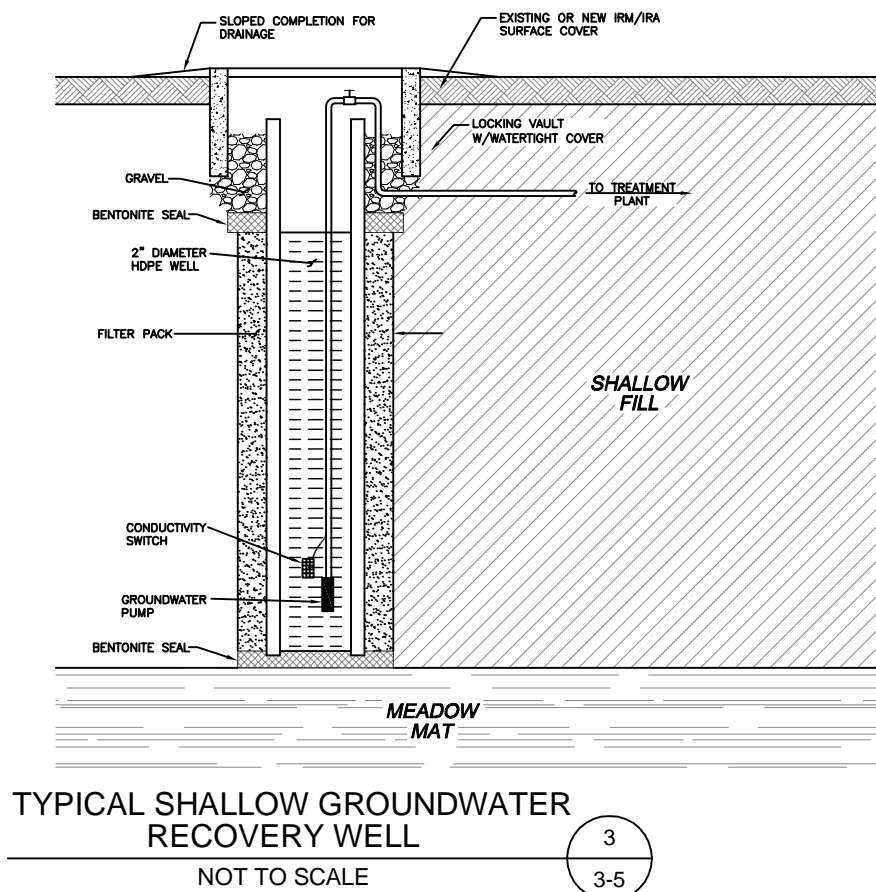
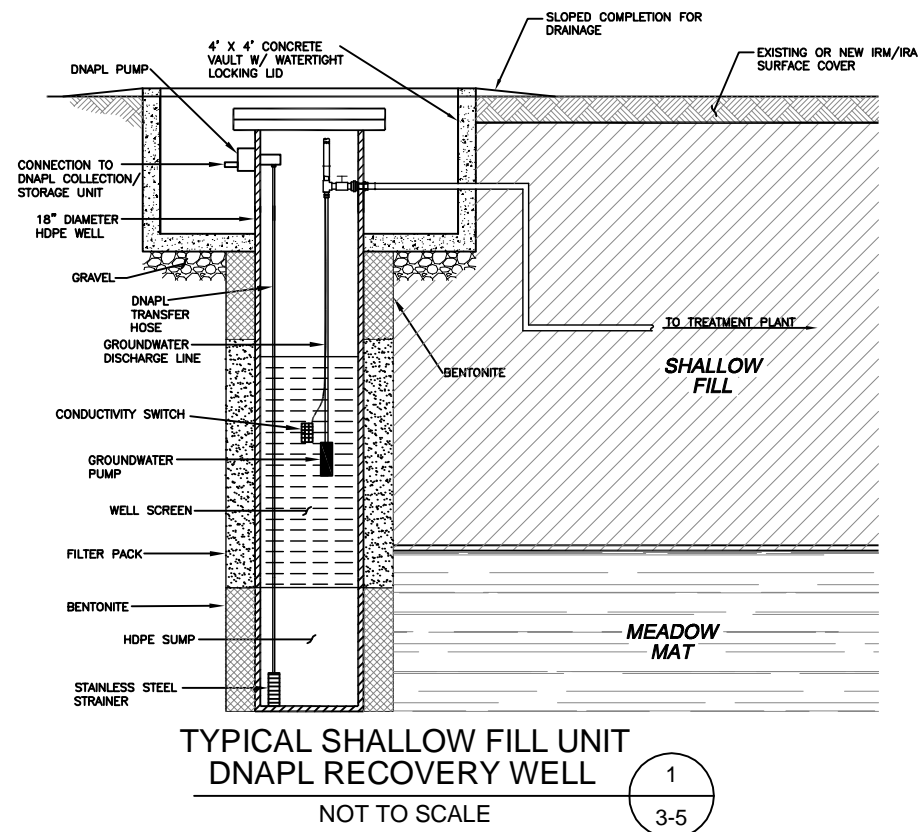
REFERENCE:

ISSUE DATE:

KEY ENVIRONMENTAL, INC.  
200 THIRD AVENUE  
CARNEGIE, PA 15106

PROCESS FLOW DIAGRAM -  
GROUNDWATER TREATMENT

PROJECT NO: 07-417  
FIGURE 3-4



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ISSUE DATE:

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200 THIRD AVENUE  
CARNEGIE, PA 15106

PENINSULA RESTORATION GROUP

DRWN: GLC	DATE: 5-07-07
CHKD: RJH	DATE: 5-07-07
APPD: JSZ	DATE: 5-07-07
SCALE: AS SHOWN	

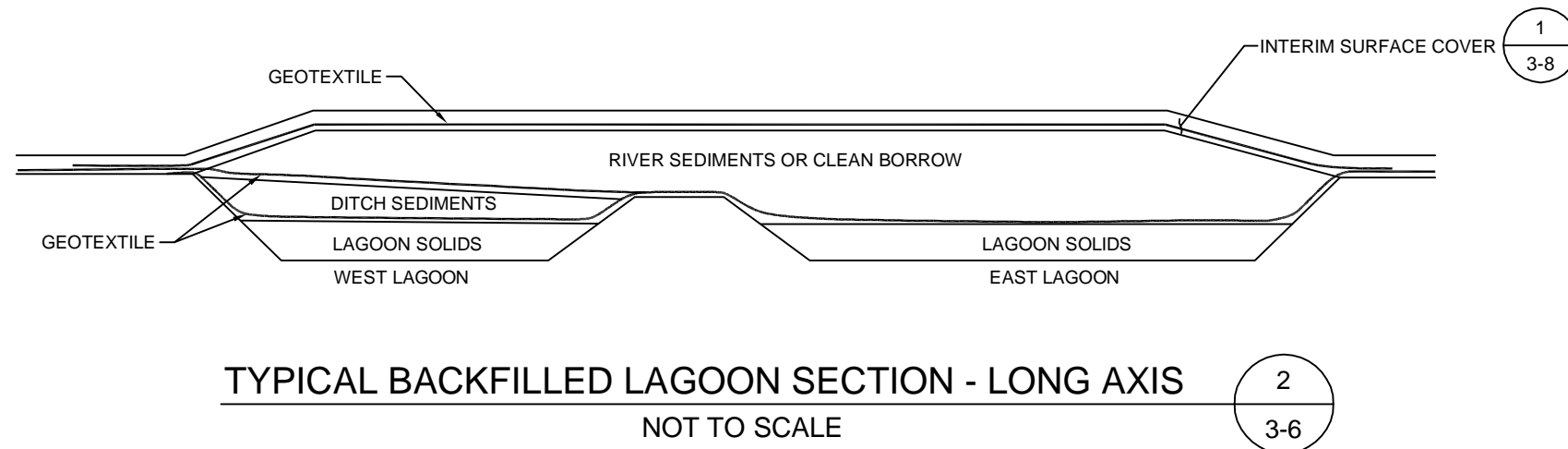
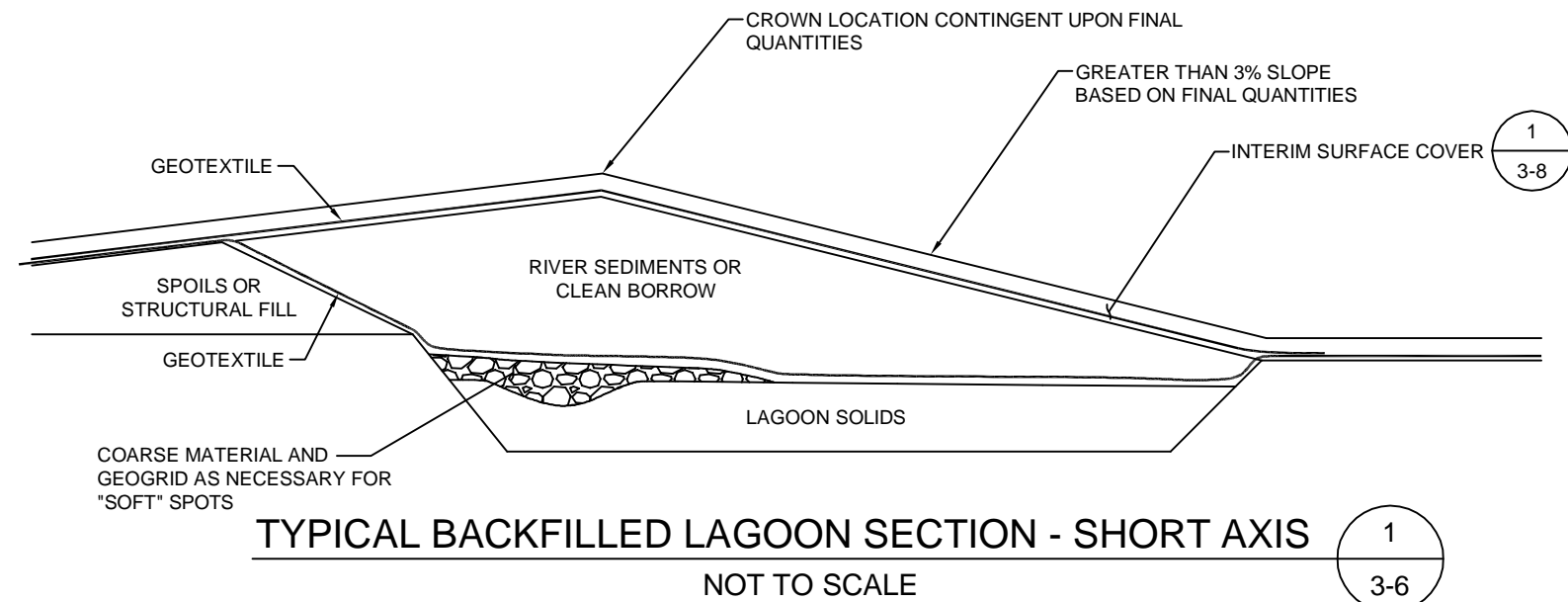


INTERIM RESPONSE ACTION WORKPLAN  
SCCC AND DIAMOND SITES  
KEARNY, NEW JERSEY

DNAPL AND SHALLOW GROUNDWATER  
RECOVERY WELL DETAILS

PROJECT NO: 07-417  
**FIGURE 3-5**

y:\Kearny\07-417\Kearny, 2007\Figure 3-6.dwg Last Saved By: Ccels 5/22/2007 11:43 AM Plotted By: Charles Jameson 5/25/2007 12:34 PM Scale: 1:1



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REFERENCE:			

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PENINSULA RESTORATION GROUP	
DRWN: GLC	DATE: 5-3-07
CHKD: RJH	DATE: 5-3-07
APPD: JSZ	DATE: 5-3-07
SCALE: AS SHOWN	<b>KEY ENVIRONMENTAL</b> <b>INCORPORATED</b>
INTERIM RESPONSE ACTION WORKPLAN SCCC AND DIAMOND SITES KEARNY, NEW JERSEY	
PROPOSED LAGOON BACKFILLING DETAILS	PROJECT NO: 07-417 FIGURE 3-6



y:\keem\07-417\keem\2007\figure 3-7.dwg Last Saved By: Goleis 5/23/2007 10:18 AM Plotted By: Charles Jameson 5/25/2007 12:34 PM Scale: 1:1

DIAMOND SITE IRA  
CONSOLIDATION AREA<sup>(1)</sup>

INTERIM SURFACE  
COVER

1  
3-8

LEGEND

- EXISTING IRM COVER  
COMPRISED OF ASPHALTIC  
CONCRETE
- EXISTING IRM COVER  
COMPRISED OF SOIL
- EXISTING IRM COVER  
COMPRISED OF GEOMEMBRANE  
OVERLAIN WITH AGGREGATE
- PROPOSED ADDITIONAL IRA  
GRAVEL COVER
- PROPOSED ADDITIONAL IRA  
GRAVEL COVER (IF NECESSARY)  
SEE NOTE 1
- PROPOSED LAGOON  
DEWATERING/BACKFILLING  
AREA
- PROPOSED DRAINAGE DITCH  
SEDIMENT REMEDIATION  
AREA
- PROPOSED RIVER SEDIMENT  
REMOVAL AREA
- PROPOSED LIMITS OF  
CONSOLIDATION AREA
- PROPOSED STORMWATER  
CULVERT DRAINAGE SYSTEM

INTERIM SURFACE  
COVER

1  
3-8

PROPOSED STORMWATER  
CULVERT DRAINAGE SYSTEM (SEE  
DETAILS ON FIGURE 3-8)

SCCC SITE IRA  
CONSOLIDATION AREA

NOTES:

- DIAMOND SITE CONSOLIDATION AREA AND COVER SYSTEM TO BE USED ONLY IF SLURRY WALL SPOILS ARE PLACED IN THIS AREA CONTINGENT UPON AOC POLICY DETERMINATION OR WASTE CLASSIFICATION.

REFERENCE: 1. VERTICAL REFERENCE: NATIONAL GEODETIC VERTICAL DATUM (NGVD 1929).

ISSUE DATE:  
  
KEY ENVIRONMENTAL, INC.  
200 THIRD AVENUE  
CARNEGIE, PA 15106

PENINSULA RESTORATION GROUP

DRWN: GLC DATE: 5-3-07  
CHKD: AEB DATE: 5-3-07  
APPD: JSZ DATE: 5-3-07  
SCALE: AS SHOWN



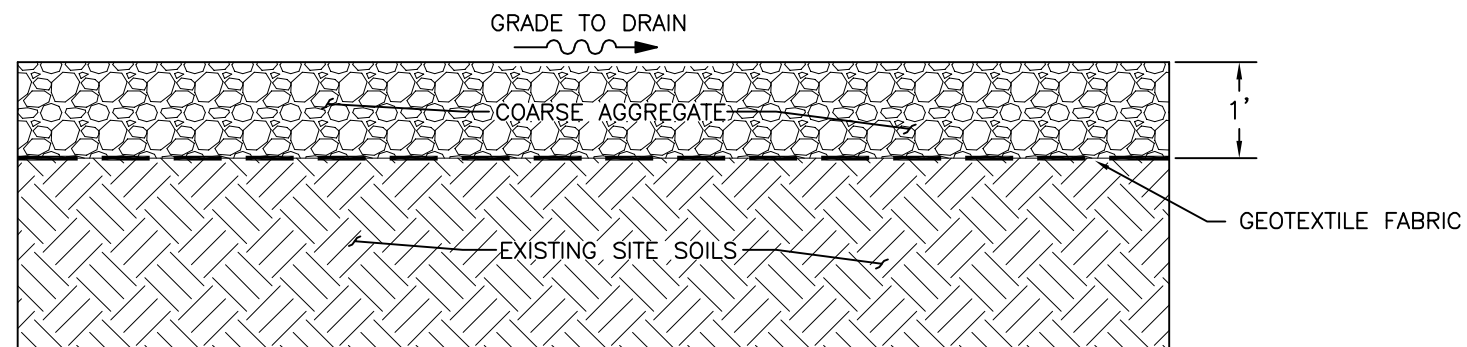
INTERIM RESPONSE ACTION WORKPLAN  
SCCC AND DIAMOND SITES  
KEARNY, NEW JERSEY

INTERIM SURFACE COVER  
AND STORM SEWER PLAN

PROJECT NO: 07-417  
FIGURE 3-7

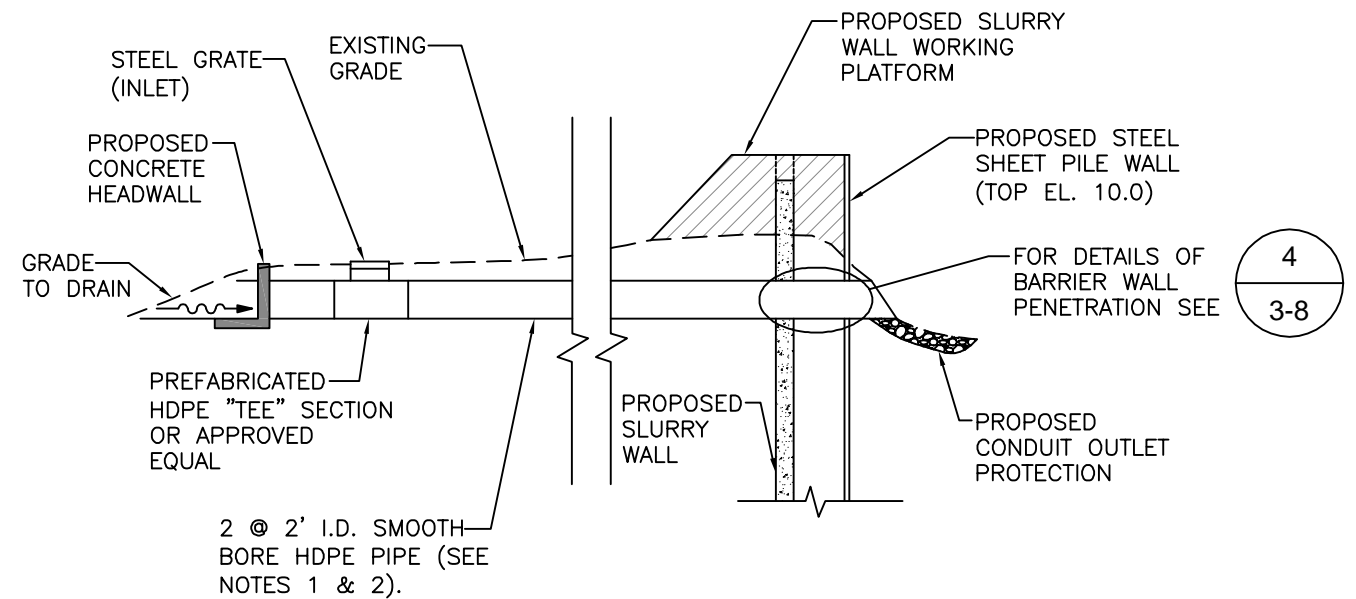
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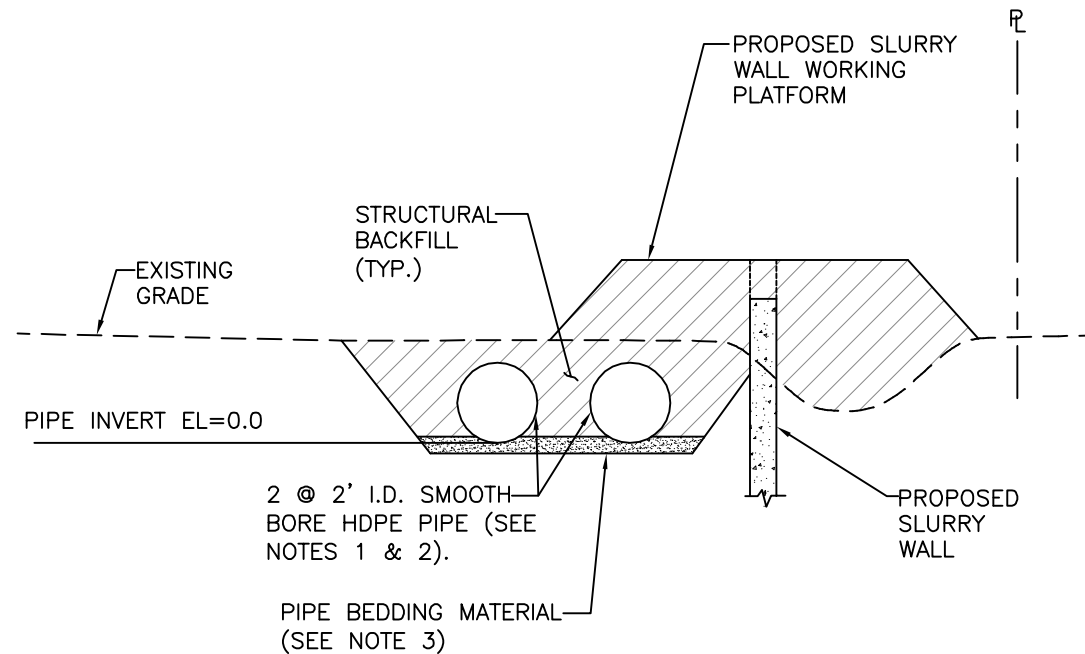
**INTERIM SURFACE COVER DETAIL**  
NOT TO SCALE

1  
3-8



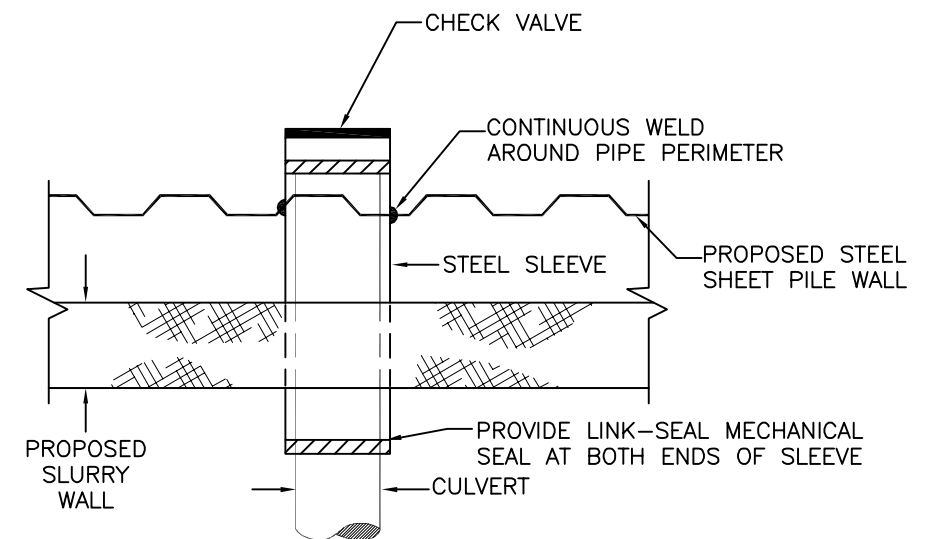
**PROPOSED CULVERT PROFILE**  
NOT TO SCALE

2  
3-8



**PROPOSED CULVERT CROSS SECTION**  
NOT TO SCALE

3  
3-8



**CROSSING OF BARRIER WALL DETAIL**  
NOT TO SCALE

4  
3-8

**NOTES:**

1. THE CULVERT WILL BE INSTALLED WITH A SLOPE OF 0% AT INV. EL 0.0 MSL.
2. HDPE PIPE JOINTS WILL BE BUTT-FUSED TO PREVENT POTENTIAL GROUNDWATER INFILTRATION.
3. PIPE BEDDING (AND BACKFILL) WILL BE IN ACCORDANCE WITH MANUFACTURES RECOMMENDATIONS.
4. ANTI-SEEP COLLARS WILL BE INSTALLED ON CULVERTS TO PREVENT FLOW THROUGH GRANULAR BACKFILL.

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REV #	DATE	DESCRIPTION	APPD

REFERENCE:

ISSUE DATE:

KEY ENVIRONMENTAL, INC.  
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PENINSULA RESTORATION GROUP

DRWN: GLC	DATE: 5-3-07
CHKD: AEB	DATE: 5-3-07
APPD: JSZ	DATE: 5-3-07
SCALE:	AS SHOWN



INTERIM RESPONSE ACTION WORKPLAN  
SCCC AND DIAMOND SITES  
KEARNY, NEW JERSEY

INTERIM SURFACE COVER  
AND STORM SEWER DETAILS

PROJECT NO: 07-417  
FIGURE 3-8

\\keerny\07-417\keerny 2007\Figure 4-1.dwg Last Saved By: Golea 5/25/2007 10:26 AM Plotted By: Charles Jameson 5/25/2007 12:34 PM Scale: 1:1

NOTE:

1. GEOTECHNICAL BORINGS GT-3 AND GT-4 WILL BE USED TO OBTAIN DATA FOR THE DNAPL RECOVERY SYSTEM DESIGN COMPARABLE TO DATA OBTAINED FROM DS-1 THROUGH DS-6.
2. SEPTIC TANK CONTENTS WILL ALSO BE SAMPLED AS DESCRIBED IN SECTION 4.7 OF THE IRAW.

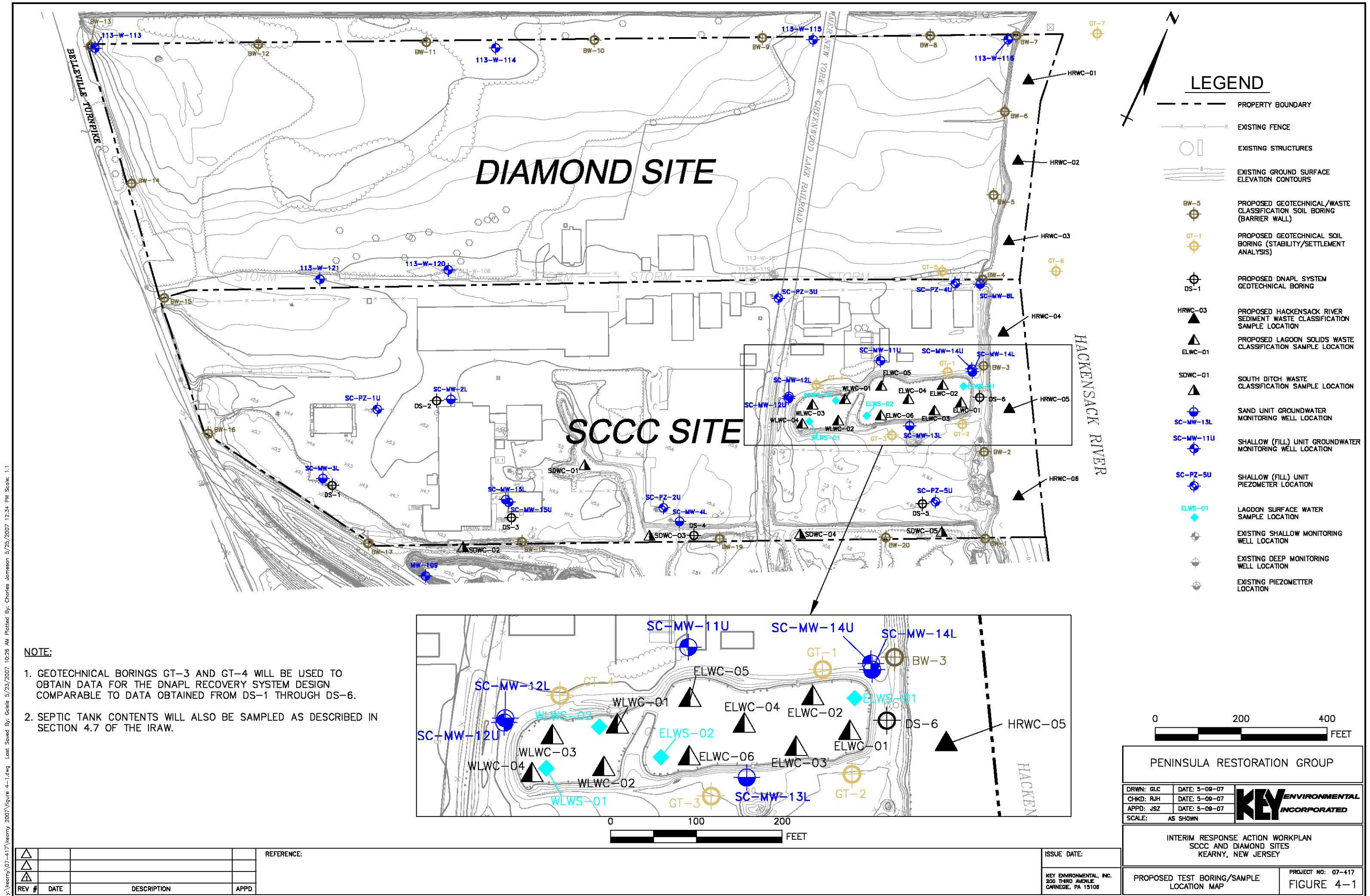
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REV #	DATE	DESCRIPTION	APPD

REFERENCE:

ISSUE DATE:

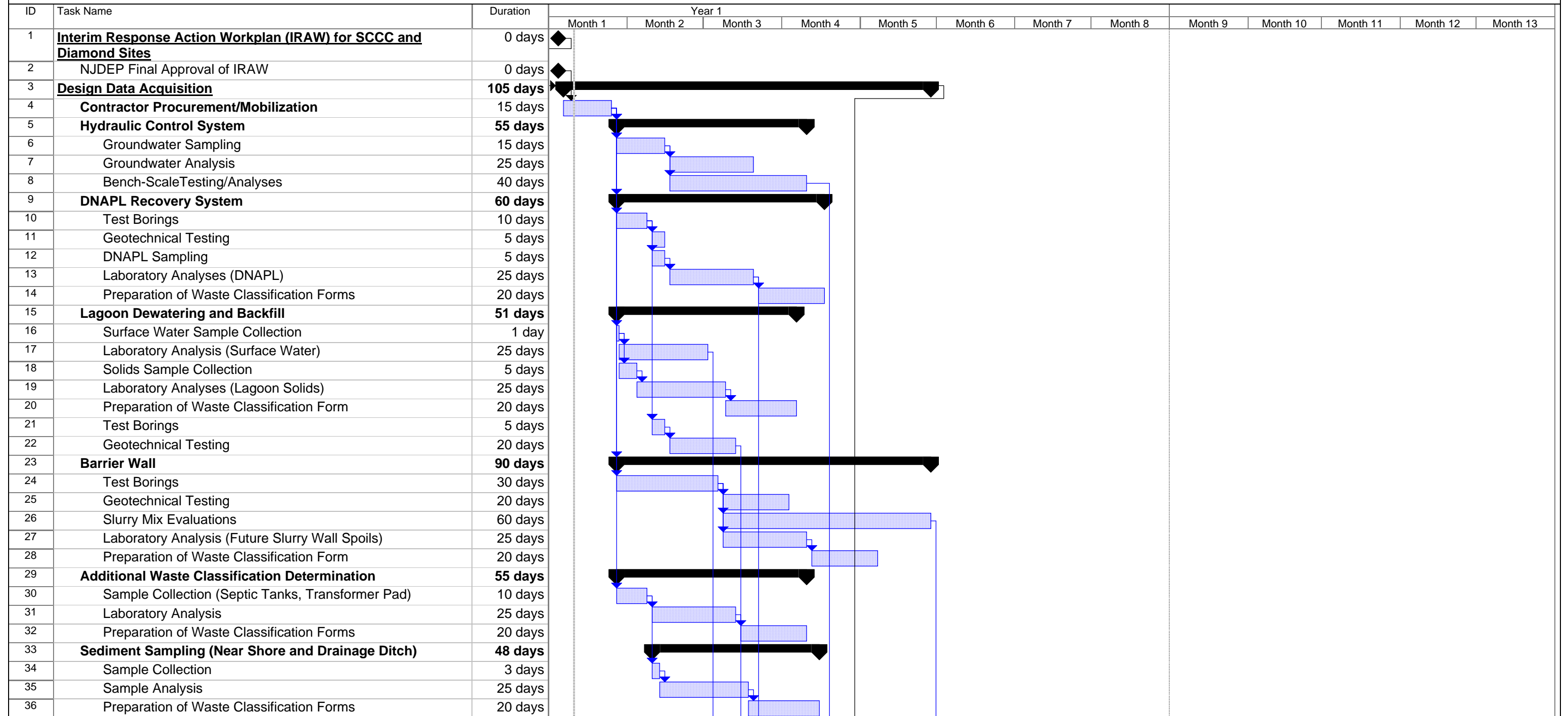
KEY ENVIRONMENTAL, INC.  
200 THIRD AVENUE  
CARNEGIE, PA 15106

PENINSULA RESTORATION GROUP	
DRWN: GLC CHKD: RJH APPD: JSZ SCALE: AS SHOWN	DATE: 5-08-07 DATE: 5-09-07 DATE: 5-09-07
INTERIM RESPONSE ACTION WORKPLAN SCCC AND DIAMOND SITES KEARNY, NEW JERSEY	
PROPOSED TEST BORING/SAMPLE LOCATION MAP	PROJECT NO: 07-417 FIGURE 4-1





**FIGURE 7-1  
DESIGN AND PERMITTING SCHEDULE  
INTERIM RESPONSE ACTION WORKPLAN  
SCCC SITE AND DIAMOND SITE  
KEARNY, NEW JERSEY**



**FIGURE 7-1  
DESIGN AND PERMITTING SCHEDULE  
INTERIM RESPONSE ACTION WORKPLAN  
SCCC SITE AND DIAMOND SITE  
KEARNY, NEW JERSEY**

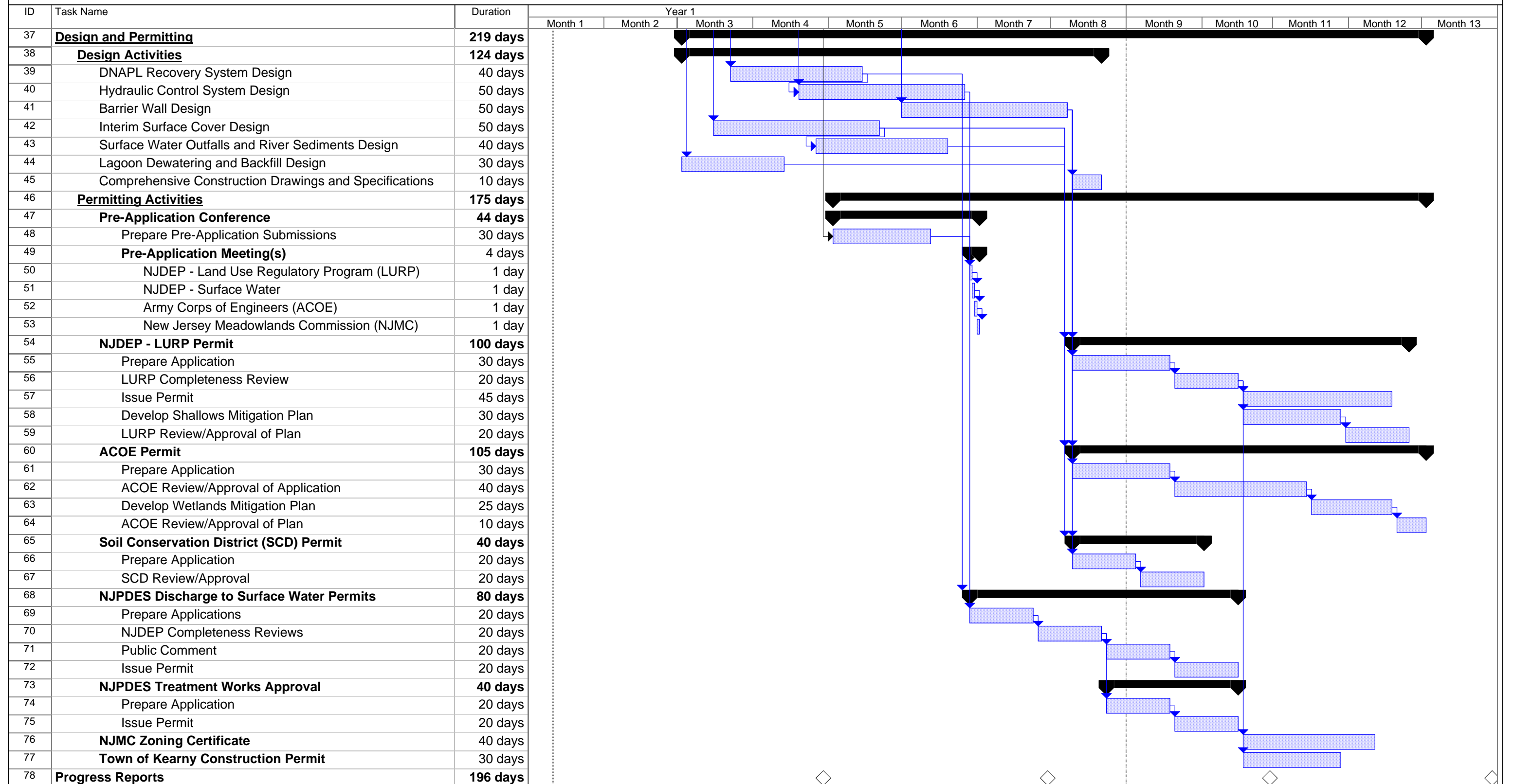
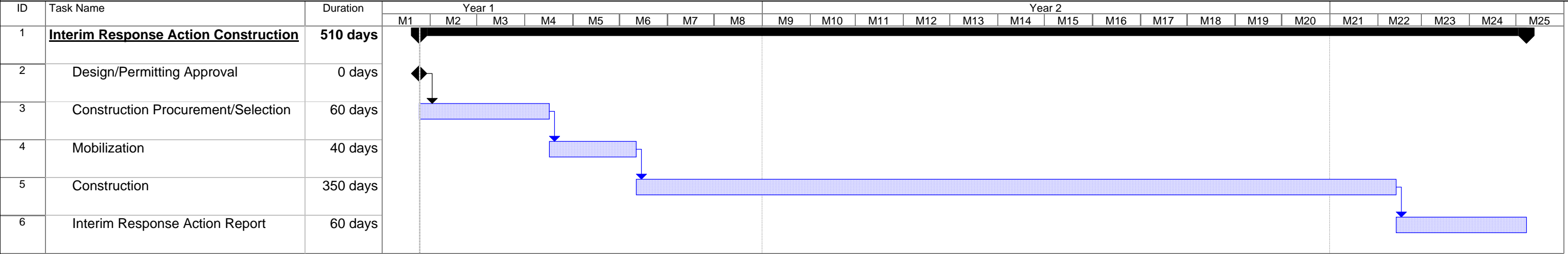


FIGURE 7-2  
INTERIM RESPONSE ACTION CONSTRUCTION SCHEDULE  
INTERIM RESPONSE ACTION WORKPLAN  
SCCC SITE AND DIAMOND SITE  
KEARNY, NEW JERSEY



## **TABLES**

**TABLE 1-1**

**N.J.A.C. 7:26E CROSS REFERENCE SUMMARY  
INTERIM RESPONSE ACTION WORK PLAN REQUIREMENTS<sup>(1)</sup>  
SCCC SITE AND DIAMOND SITE  
KEARNY, NEW JERSEY**

Relevant Subpart of New Jersey Administrative Code Section 7:26E	IRAW Section
<b>N.J.A.C. 7:26E-5.1 (Remedial Action Selection)</b>	
(b). A person selecting a remedial action shall first establish the remedial action objectives/goals for the site or area of concern by: 1. Identifying all media of concern; 2. Selecting applicable remediation standards based on the current and future land use for the site; 3. For each media of concern, selecting between active treatment versus containment and exposure controls; and 4. For contaminated soil, selecting among an unrestricted use, limited restricted use or restricted use remedial action.	IRAW §1.2 and §1.3
(c). A person responsible for conducting a remediation for a site shall select a remedial action that reduces or eliminates exposure to contaminants above the applicable remediation standard. In determining the appropriate remedial action that will reduce or eliminate exposure to contaminants above the applicable remediation standard, the person responsible for conducting the remediation shall select, develop and implement a remedial action that is based on the following factors:	IRAW §1.3 and §1.4
(c)1. The ability of the remedial action to protect the public health and safety and the environment, including: i. The technical performance and effectiveness of the remedial action in attaining compliance with the applicable remediation standards; ii. The reliability of the remedial action in maintaining compliance with the applicable remediation standards; iii. The degree to which the proposed remedial action reduces toxicity, mobility, or volume of contaminants through treatment, reuse or recycling; iv. The degree to which the remedial action minimizes risks and short-term impacts associated with the implementation of the remedy and with any contamination left onsite, while still providing long-term protection; and v. The degree to which the potential for off-site migration of contamination through erosion, subsurface migration or other migration pathways is mitigated or eliminated;	IRAW §1.3 and §1.4

TABLE 1-1

**N.J.A.C. 7:26E CROSS REFERENCE SUMMARY  
INTERIM RESPONSE ACTION WORK PLAN REQUIREMENTS<sup>(1)</sup>  
SCCC SITE AND DIAMOND SITE  
KEARNY, NEW JERSEY**

Relevant Subpart of New Jersey Administrative Code Section 7:26E	IRAW Section
N.J.A.C. 7:26E-5.1 (Remedial Action Selection – Continued)	
(c)2. The implementability of the proposed remedial action, including: <ul style="list-style-type: none"> <li>i. The engineering and scientific feasibility and availability of the technologies that the proposed remedial action would employ. If treatability, bench scale, or pilot studies have been conducted pursuant to N.J.A.C. 7:26E-4.1(a)4, these results shall be utilized to determine whether or not the proposed remedial action is technically feasible;</li> <li>ii. The ability of the person responsible for conducting the remediation to implement the proposed remedial action within a reasonable time frame. A proposed remedial action will be considered timely if it will achieve the applicable remediation standard within five years from the time the remedy is implemented, or in the case where Department approval of a remedial action workplan is required or sought, five years from remedial action workplan approval. Remedial actions to address immediate environmental concerns shall be considered timely as specified by the Department in an oversight document pursuant to N.J.A.C. 7:26C; and</li> <li>iii. The property owner's written agreement to the implementation of the limited restricted use or restricted use remedial action including all requirements for engineering and institutional controls pursuant to N.J.A.C. 7:26E-8;</li> </ul>	IRAW §1.4
(c)3. The consistency of the proposed remedial action with other applicable Federal, State and local laws and regulations, including, without limitation, the provisions of the Pinelands Protection Act, P.L. 1979, c.111 (N.J.A.C. 13:18A-1 et seq.), any rules promulgated pursuant thereto, and the provisions of section 502 of the National Parks and Recreation Act of 1978, 16 U.S.C. §4711;	IRAW §1.3 and §1.4
(c)5. The potential for the selected action to cause natural resource injury. <ul style="list-style-type: none"> <li>i. Examples of remedial actions that may cause natural resource injury include, without limitation: <ul style="list-style-type: none"> <li>(1) Pumping ground water that deprives a wetland of its primary water source;</li> <li>(2) Capping a landfill which involves destroying adjacent wetland; and</li> <li>(3) Pump and treat ground water remedial action with discharge to surface water.</li> </ul> </li> <li>ii. Examples of information that would be evaluated when assessing a ground water remedial action include, without limitation:</li> </ul>	IRAW §1.3 and §1.4



**TABLE 1-1**

**N.J.A.C. 7:26E CROSS REFERENCE SUMMARY  
INTERIM RESPONSE ACTION WORK PLAN REQUIREMENTS<sup>(1)</sup>  
SCCC SITE AND DIAMOND SITE  
KEARNY, NEW JERSEY**

Relevant Subpart of New Jersey Administrative Code Section 7:26E	IRAW Section
<b>N.J.A.C. 7:26E-5.1 (Remedial Action Selection – Continued)</b>	
<p>(1) Whether the site is located in a water supply surplus or deficit area as defined in the State's Water Supply Master Plan (New Jersey Department of Environmental Protection, "Water for the 21st Century: The Vital Resource," August 1996) or the version most recent to the submission;</p> <p>(2) Whether the remedial action will be active or passive; and</p> <p>(3) If a pump and treat remedial action is proposed, the volume of water to be pumped over the life of the action, the estimated duration of pumping, and where the treated water would be discharged</p>	
<b>N.J.A.C. 7:26E-6.1 (Remedial Action Requirements)</b>	
(b) Each remedial action implemented at a contaminated site shall: 4. Not in itself cause an uncontrolled or unpermitted discharge or transfer of contaminants from one media to another.	IRAW §5.0
<b>N.J.A.C. 7:26E-6.2 (Remedial Action Workplan)</b>	
(a) If a remedial action workplan is required by the Department in an oversight document or pursuant to the ISRA or UST programs, or if the person responsible for conducting the 7:26E-6.2 Remedial action workplan remediation elects to obtain Department pre-approval for the workplan, the workplan shall be submitted in accordance with the schedule contained in that document, if applicable, and shall be presented in a format that corresponds directly to the outline of this section. The workplan shall include:	As below
(a)1. The remedial investigation report, pursuant to N.J.A.C. 7:26E-4.8, shall be presented as the first section of the remedial action workplan. If the remedial investigation report was previously submitted to the Department, either a summary of the report or a copy of the findings/recommendation section of the report may be submitted;	IRAW §2.2 and §2.3
(a)2. A sampling summary table for post remediation samples pursuant to N.J.A.C. 7:26E-4.2 (remedial investigation workplan);	Appendix E (FSP): Table 2-1
(a)3. A proposal to complete all requirements in N.J.A.C. 7:26E-6;	IRAW §1.0

**TABLE 1-1**

**N.J.A.C. 7:26E CROSS REFERENCE SUMMARY  
INTERIM RESPONSE ACTION WORK PLAN REQUIREMENTS<sup>(1)</sup>  
SCCC SITE AND DIAMOND SITE  
KEARNY, NEW JERSEY**

<b>Relevant Subpart of New Jersey Administrative Code Section 7:26E</b>	<b>IRAW Section</b>
<b>N.J.A.C. 7:26E-6.2 (Remedial Action Workplan - Continued)</b>	
(a)4. The identification of all applicable remediation standards;	IRAW §1.3
(a)5. A detailed description of the remedial action and the remedial technology to be conducted for each area of concern;	IRAW §3.0
(a)6. The identification of all areas where remedial action will be conducted on a scaled site map pursuant to N.J.A.C. 7:26E-4.8 (remedial investigation report). In addition, the map shall specify: <ul style="list-style-type: none"> <li>i. The location of remedial treatment units;</li> <li>ii. The volume of each environmental medium to be remediated;</li> <li>iii. The vertical and horizontal extent of area to be remediated;</li> <li>iv. The location, depth and concentration of all contaminants in excess of the remediation standard; and</li> <li>v. Sample locations, depths and parameters for all post-construction samples;</li> </ul>	IRAW Figures 3-1 and 3-7
(a)7. A quality assurance project plan including proposed sampling and analytical methods pursuant to N.J.A.C. 7:26E-2.2;	Appendix D (QAPP) Appendix E (FSP)
(a)8. A list of all required permits;	IRAW §5.0 and Table 5-1
(a)9. If any construction activity is planned, the following items shall be provided in the workplan: <ul style="list-style-type: none"> <li>i. The location of any such construction facilities with additional details describing construction design;</li> <li>ii. All applicable requirements and standards relating to construction for onsite remedial units including inspection and professional engineer certification.</li> </ul>	Figures 3-1 - 3-8 and Final Design

**TABLE 1-1**

**N.J.A.C. 7:26E CROSS REFERENCE SUMMARY  
INTERIM RESPONSE ACTION WORK PLAN REQUIREMENTS<sup>(1)</sup>  
SCCC SITE AND DIAMOND SITE  
KEARNY, NEW JERSEY**

<b>Relevant Subpart of New Jersey Administrative Code Section 7:26E</b>	<b>IRAW Section</b>
<b>N.J.A.C. 7:26E-6.2 (Remedial Action Workplan - Continued)</b>	
(a)10. A description of soil and sediment erosion control and monitoring, and dust and odor control and monitoring procedures to be implemented during remedial activities, if applicable;	IRAW §5.1 and Appendix C (HASP)
(a)11. A health and safety plan pursuant to N.J.A.C. 7:26E-1.9;	Appendix C (HASP)
(a)12. A detailed description of site restoration plans to comply with N.J.A.C. 7:26E-6.4 (post-remediation action requirements);	Final Remedy
(a)13. A description of procedures for dismantling and removal of remedial structures and equipment from the site, if applicable;	IRAW §3.7
(a)14. A cost estimate of the remedial action;	IRAW §6.0
(a)15. The proposed completion date of the remedial action and a schedule of the remedial action as required pursuant to N.J.A.C. 7:26E-6.5;	IRAW §7.0 Figure 7-1 Figure 7-2
(a)16. The following documentation whenever a deed notice is required as a component of the remedial action: i. A copy of the property owner's written agreement to record the deed notice, pursuant to N.J.A.C. 7:26E-8.2(b); and ii. A draft deed notice, including all of the exhibits, pursuant to N.J.A.C. 7:26E-8.2(c)	Final Remedy
(a)17. All documentation required pursuant to N.J.A.C. 7:26E-8.3 whenever a classification exception area is to be established;	Final Remedy

**TABLE 1-1**

**N.J.A.C. 7:26E CROSS REFERENCE SUMMARY  
INTERIM RESPONSE ACTION WORK PLAN REQUIREMENTS<sup>(1)</sup>  
SCCC SITE AND DIAMOND SITE  
KEARNY, NEW JERSEY**

Relevant Subpart of New Jersey Administrative Code Section 7:26E	IRAW Section
<b>N.J.A.C. 7:26E-6.2 (Remedial Action Workplan - Continued)</b>	
(b) If contaminated soil will be reused at a site, an evaluation pursuant to N.J.A.C. 7:26E-6.4(d) shall be conducted and a soil reuse proposal shall be submitted to the Department as part of the remedial action workplan. The soil reuse proposal may also be submitted at any time during the remediation process, as appropriate. At a minimum, the soil reuse proposal shall include:	Not applicable
(b)1. A description of the originating site or area of concern by the submission of a remedial investigation report or, as applicable, a remedial action report for the contaminated soil. If the reports were previously submitted to the Department, a summary of the report may be submitted;	Not applicable
(b)2. A determination in accordance with N.J.A.C. 7:26-8.5 as to the waste classification of the soil, including any supporting data requested by the Department; and	Not applicable
(b)3. A detailed description of the proposed reuse and conditions at the site of reuse including: i. The location of the site including state, county, municipality, block and lot numbers; ii. The volume of soil to be reused; iii. Identification of the specific location on the site where the reuse will be conducted on a scaled maps pursuant to N.J.A.C. 7:26E-3.2(a)3i through iii; iv. The depth to ground water on the receiving site, including the method of determination; v. The receiving site use; vi. A discussion of the performance, effectiveness and reliability of the proposed reuse and any potential negative impacts to human health, safety or the environmental as a result of the reuse; and vii. All other applicable data and information required pursuant to (a)8 through 15.	Not applicable

**TABLE 1-1**

**N.J.A.C. 7:26E CROSS REFERENCE SUMMARY  
INTERIM RESPONSE ACTION WORK PLAN REQUIREMENTS<sup>(1)</sup>  
SCCC SITE AND DIAMOND SITE  
KEARNY, NEW JERSEY**

<b>Relevant Subpart of New Jersey Administrative Code Section 7:26E</b>		<b>IRAW Section</b>
<b>N.J.A.C. 7:26E-6.2 (Remedial Action Workplan - Continued)</b>		
(c) If historic fill material will not be treated or removed from the Site, engineering and institutional controls shall be proposed, provided that the information is pursuant to 7:26E-4.8(c)14 and the following documentation is presented in the remedial action work plan:		Final Remedy
(c)1. Statement that all other areas of concern located in the historic material has been addressed as separate areas of concern. Remedies for any such areas not meeting the definition of historic fill material shall be selected pursuant to 7:26E-5.1		Final Remedy

1. N.J.A.C. 7:26E does not identify specific requirements for an interim response action. The remedial action requirements specified in N.J.A.C. 7:26E have been identified as appropriate requirements by the NJDEP. The cross reference summary contained in this table is based on the assumed applicability of these requirements to the interim responses. The specific sections of N.J.A.C. 7:26E referenced in the NJDEP comments dated April 11, 2007 on the Draft IRAW dated June 2006, as well as all of the requirements for a remedial action work plan (N.J.A.C. 7:26E-6.2) are included in this cross-reference summary table. Some requirements (e.g., final site restoration, institutional controls) are components of the final remedy and are not addressed in this IRAW. Such items are identified as "Final Remedy Components."

TABLE 6-1

**INTERIM RESPONSE ACTION COST ESTIMATE  
SCCC AND DIAMOND SITES - KEARNY, NEW JERSEY**

Description	Item Cost
<b>Capital Costs</b>	
Site Preparation Activities	\$1,195,000
DNAPL Recovery System	\$271,000
Barrier Walls	\$4,433,125
Final Cover System	\$633,600
Diamond Site Hackensack River Sediments	\$66,000
SCCC Site Hackensack River Sediments	\$66,000
SCCC East and West Lagoons	\$112,400
SCCC South Ditch	\$60,000
Hydraulic Control Recovery Well System (Full Enclosure)	\$364,155
Hydraulic Control Groundwater Treatment Sytem	\$350,000
Design/Permitting/CQA	\$1,040,000
<b>Total Capital Cost</b>	<b>\$8,591,280</b>
<b>Operation and Maintenance Costs</b>	
Groundwater Hydraulic Monitoring	\$48,000
DNAPL Recovery System O&M	\$240,000
Groundwater Treatment System O&M	\$500,000
Final Cover System Inspection and Maintenance	\$20,000
<b>Total Present Worth of O&amp;M (2 Years)</b>	<b>\$808,000</b>
<b>Present Worth</b>	<b>\$9,399,280</b>

**VOLUME II of III**

**APPENDICES A - F**

## **APPENDIX A**

### **GROUNDWATER MODELING RESULTS**



## **Appendix A**

### **Summary of Hydraulic Control Simulation**

#### **Fully Enclosing Barrier Wall and Groundwater Pumping Scenario**

**Simulation with partial cover system:** Figure 1 shows the simulated potentiometric surface for the enclosed barrier wall system around the perimeter of the Diamond and SCCC sites with current conditions (i.e., recharge is equivalent to 0.36 in/yr in paved areas and 3.6 in/yr in unpaved areas). Figure 1 also shows areas where the model currently simulates groundwater (GW) levels above land surface (primarily wetlands and drainage ditches). Note that red cells denote water levels within 1 foot of land surface. Twenty-three pumping wells were simulated at a total of 8.1 GPM to reverse the downward hydraulic gradient and maintain hydraulic capture within the containment barrier wall surrounding the Diamond and SCCC sites. The 6 wells along the western portion of the northern property boundary are pumping at 0.2 gpm and the 3 wells along the eastern portion of the northern property boundary are pumping at 0.1 GPM per well. The rest of the wells are pumping at 0.5 GPM per well. All model cells at both sites show upward vertical gradients due to pumping at a total of 8.1 GPM and have water levels at least 2 ft below land surface. The minimum water level at the Site is approximately -1.0 ft msl.

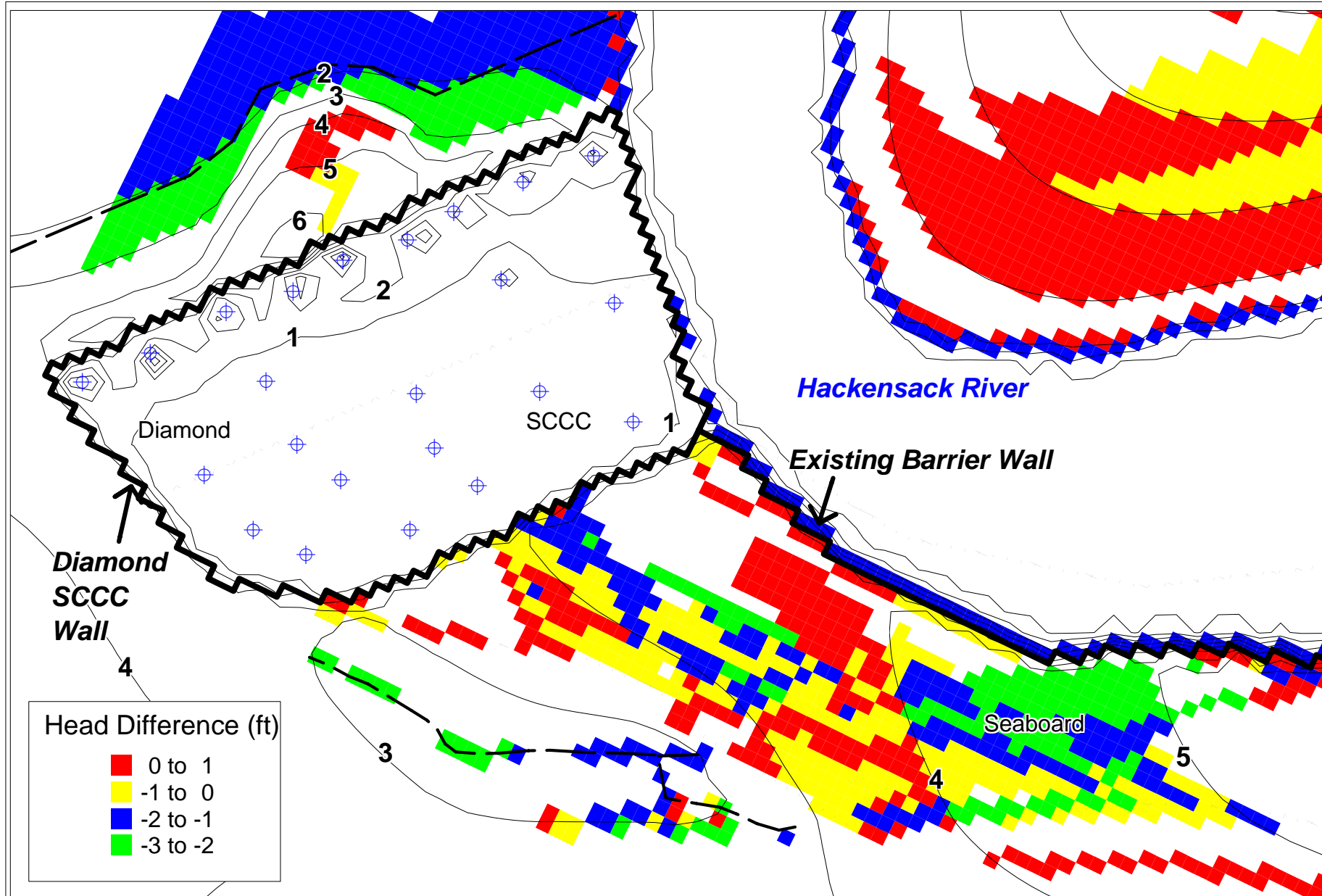
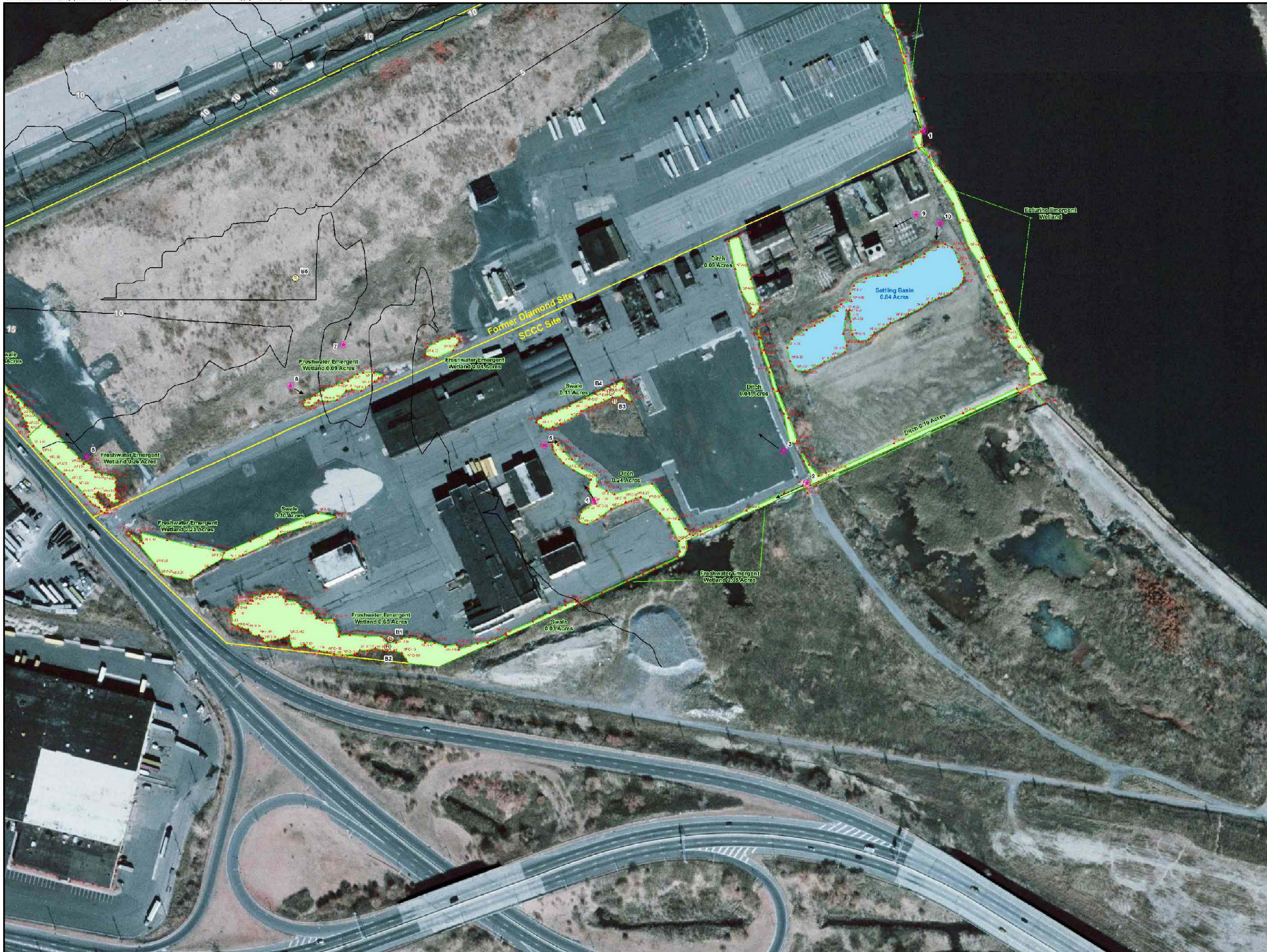


Figure 1b. Model-simulated potentiometric surface contours and areas where the potentiometric surface is projected to be above land surface [Run 1B, Diamond/SCCC Wall, 8.1 GPM Total, 0.36/3.6 in recharge on Site].

**APPENDIX B**  
**WETLAND DELINEATION MAP**





DATA SOURCES / NOTES

1. SITE BOUNDARIES ARE NOT AN OFFICIAL PLS SURVEY. SITE BOUNDARIES MAY BE INACCURATE.
2. 2002 AERIAL PHOTOGRAPH OBTAINED FROM NJ DEP (IMAGE WAREHOUSE).
3. PHOTO LOCATIONS AND BORING LOCATIONS LOCATED ON MAP THROUGH HEADS-UP DIGITIZING.
4. WETLAND LINE AND TAGS SURVEYED BY GEOD SURVEYING AND AERIAL MAPPING, NEWFOUNDLAND, NEW JERSEY.
5. CONTOURS CREATED FROM 10 METER DIGITAL ELEVATION MODEL. CONTOURS DO NOT REPRESENT ON-SITE TOPOGRAPHY.

0 90 Feet  
1 inch equals 90 feet

Contours 5ft Intervals  
Site Boundaries  
Wetland Fags  
Non-Regulated Water Feature  
Wetland Areas  
Boring Locations  
Photo Locations

↑ N

**PRINCETON HYDRO, LLC** **pH**

SCIENTISTS AND ENGINEERS  
1106 OLD YORK ROAD, SUITE 1  
P.O. BOX 720  
RINGGERS, NEW JERSEY 08551  
PHONE: 908.237.5660  
FAX: 908.237.5668  
WWW.PRINCETHYDRO.COM

PROJECT NAME/LOCATION:  
KEY ENVIRONMENTAL  
STANDARD CHLORINE CHEMICAL  
COMPANY & FORMER DIAMOND SITE  
TOWN OF KEARNY  
HUDSON COUNTY, NEW JERSEY

DRAWING NAME  
SITE PLAN  
BLOCK 287  
LOTS 48, 47, 48, 49, 50, 51, 52 & 52R

DATE:	August 16, 2006
PROJECT NO.:	0502.002
SCALE:	1" = 90'
DRAWN BY:	JPR
CHECKED BY:	HC

SHEET NO.:

1 1

OF



## **APPENDIX C**

### **HEALTH AND SAFETY PLAN**

**INTERIM RESPONSE ACTION WORKPLAN  
HEALTH AND SAFETY PLAN**

**STANDARD CHLORINE CHEMICAL SITE  
AND DIAMOND SITE  
KEARNY, NEW JERSEY**

*Prepared for:*

**The Peninsula Restoration Group  
(Standard Chlorine Chemical Company, Tierra Solutions, Inc. and Beazer East, Inc.)**

*Prepared by:*

**Key Environmental, Inc.**  
200 Third Avenue  
Carnegie, Pennsylvania 15106

**May 2007**

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## **REVISIONS/ADDENDA TO HEALTH AND SAFETY PLAN**

<b>Revision</b>	<b>Date</b>	<b>Issued By</b>	<b>Revisions Made</b>
0	5/17/07	John Francis	Original HASP

## **1.0 INTRODUCTION**

This Health and Safety Plan (HASP) describes the program to be implemented by Key Environmental, Inc. (KEY) for Interim Response Actions at the Standard Chlorine Chemical Company (SCCC) Site and Diamond Site located in Kearny, New Jersey. The Site location is shown on **Figure 1-1**. All work must be performed in accordance with applicable federal, state, and local regulations, including, but not limited to:

- U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) - 29 Code of Federal Regulations (CFR) 1910.120, "Hazardous Waste Operations and Emergency Response"; and,
- OSHA - 29 CFR 1926, "Safety and Health Regulations for Construction."

The health and safety practices, procedures, and personal protective equipment (PPE) requirements established within this HASP are based on hazards known to be present at this Site. All protective measures employed must be commensurate with known hazards associated with specific work activities and job tasks and must be modified if other hazards are identified during the course of the work.

This HASP should not be used for activities other than those outlined in the scope of work unless a task-specific hazard and exposure assessment is performed and any additional protective measures incorporated into the HASP.

## **2.0 PROGRAM ORGANIZATION AND RESPONSIBILITIES**

The design and implementation of the HASP are accomplished through an integral team effort comprised of the following:

- Project Manager - The Project Manager is responsible for assuring that all activities are conducted in accordance with the HASP. The Project Manager has the authority to suspend field operations if employees are in danger of injury or overexposure to harmful agents. The Project Manager's responsibilities include:
  - Coordinating the development of a Site-specific HASP for all phases of the project;
  - Ensuring that the appropriate health and safety equipment and PPE are available for project personnel;
  - Ensuring that all personnel have received the appropriate training before they engage in activities that are potentially hazardous;
  - Ensuring that all required personnel have received the required medical examination, testing, and screening before engaging in work activities; and
  - Designating a Site Health and Safety Officer (SHSO) and other Site personnel who will assure compliance with the HASP.
- Project Site Supervisor/SHSO - The Site Supervisor also acts as the SHSO and is responsible for ensuring that all Site activities are conducted in accordance with the HASP. The Site Supervisor reports to the Project Manager. The Site Supervisor's responsibilities include:
  - Ensuring that personnel, subcontractor personnel, and visitors comply with the requirements of this HASP;
  - Notifying the Project Manager of any changes in work conditions or tasks which may require changes to the HASP;
  - Suspending field activities if necessary, and resume activities when appropriate;
  - Coordinating safety meetings and daily safety briefings, as necessary;
  - Managing health and safety equipment, including instruments, respirators, gloves, suits, and other PPE, used in field activities;
  - Acting as the Emergency Coordinator at the Site and arrange for emergency response in cooperation with local emergency and health officials;
  - Monitoring conditions during field activities to assure compliance with HASP;
  - Monitoring conditions during field activities to determine if more stringent procedures or a higher level of PPE should be implemented;

- Maintaining a log to record conditions, personnel involved in field activities, and other pertinent health and safety data;
  - Overseeing the arrangement and execution of personnel and equipment decontamination;
  - Controlling visitor, subcontractor, and employee access to hazardous areas; and
  - Delegating, if necessary and appropriate, some of these responsibilities to other on-Site qualified employees.
- Employees and Subcontractors - Employees and subcontractors will be responsible for the following:
  - Becoming familiar with, and complying with, the HASP;
  - Attending training sessions to review the HASP and other safety and health information;
  - Being alert to identified and non-identified hazards;
  - Reporting unidentified hazards to the SHSO; and
  - Conducting themselves in a manner that is orderly and appropriate for the Site.

### **3.0 SITE CHARACTERIZATION AND HAZARD ASSESSMENT**

#### **3.1 SITE BACKGROUND AND DESCRIPTION**

Two sites, the SCCC Site and the former Diamond Shamrock (Diamond) Site, are the subjects of this HASP. These Sites are located adjacent to each other and to the Seaboard Site on what is known as the Kearny Peninsula in Kearny, New Jersey. Response actions are being performed by KEY for the Peninsula Restoration Group (“Group”). The Group is comprised of SCCC, Tierra Solutions, Inc. (Tierra), the current owner of the Diamond Site, and Beazer East, Inc. (Beazer), a former owner of the SCCC Site.

##### **3.1.1 SCCC Site**

The SCCC Site consists of approximately 25 acres bounded by the Hackensack River to the east, Belleville Turnpike to the west, the Diamond Site to the north and northwest, and by the Seaboard Site to the south. **Figure 1-1** is a topographic map showing the Site location. Figure 2 is a site plan which also shows the locations of former structures. The Site is relatively flat and is fenced along most of the perimeter. Manufacturing operations were conducted at the Site by various entities between 1916 and 1993, and included the refining of naphthalene, the manufacture of products from naphthalene, naphthalene derivatives and dichlorobenzenes, the formulation of drain cleaning products, and, on a limited basis during the 1970s, the processing of trichlorobenzene. The naphthalene refining operations were conducted in the eastern two-thirds of the Site. The manufacture of dichlorobenzene products and the formulation of drain cleaning products occurred in the western one-third of the property. Trichlorobenzene processing occurred in the northeastern section of the Site.

##### **3.1.2 Diamond Site**

The Diamond Site is approximately 27 acres in area. The Diamond Site is bounded by the Hackensack River to the east, Belleville Turnpike to the west, an elevated Amtrak railway line

and associated embankment to the north, and the SCCC Site to the south. Figure 2-3 presents a site map for the Diamond Site. With the exception of two structures the site has been razed.

The facility engaged in the processing of imported chromite ore for the production of sodium bichromate, which was sold and used in the manufacture of chromium chemicals. Chemicals manufactured onsite included chrome-based leather tanning agents and chromic acid. Processing of chromite ore for the production of sodium bichromate continued until November 1971. Production of tanning agents and chromic acid at the site ceased in December 1976, and the majority of the structures on the Site were razed in 1978.

Remedial investigations and certain interim remedial measures have been implemented at this Site but additional characterization is required to collect data for response actions.

### **3.2 SCOPE OF WORK**

This HASP covers actions as detailed in the Interim Response Action Workplan.<sup>1</sup> The main components of the response actions include:

- Installation of a physical hydraulic barrier around both sites – Slurry wall around the perimeter of the combined sites and a steel sheet pile wall as an additional structural element along the Hackensack River frontage of both sites;
- Construction of a groundwater recovery and treatment system;
- Installation of a Dense Non-Aqueous Phase Liquid (DNAPL) recovery system for off-site management;
- Lagoon dewatering and backfilling – pump, treat and discharge water to the river then backfill and cover placement;
- Removal of near-shore sediments then consolidation on-site and/or shipped off-site;
- Installation of surface cover and associated stormwater controls.

Other tasks that will be performed during the interim remedial actions include clearing and grubbing; removal of a former transformer pad; fencing; management of soils and water (impacted and non-impacted); removal of two septic tanks; and access road improvements.

---

<sup>1</sup> Key Environmental, Inc., Interim Response Action Workplan (IRAW), Standard Chlorine Chemical Company and Diamond Site, Kearny, New Jersey. May 2007.

Contractors who perform activities outside the scope of this HASP must develop their own site-specific HASP to address the work they will perform at the Site.

### **3.3 CHEMICAL HEALTH HAZARDS**

Potential health hazards at the SCCC Site include the potential exposure to volatile and semivolatile organic compounds (VOCs and SVOCs), particularly chlorobenzenes and naphthalene; chromium and hexavalent chromium. Dioxin was found at the Site in very low concentrations in the Lagoon and in surface soils near the former dichlorobenzene tank area. Low levels of dioxin may present on or in building materials at the former distillation area.

SCCC sampling data indicate VOCs/SVOCs in the soil including chlorobenzene, dichlorobenzenes, trichlorobenzenes, and naphthalene at varying concentrations up to several thousand parts per million.

Groundwater at the SCCC Site contains lower concentrations of these constituents. Total dichlorobenzenes may be found up to approximately 30 to 84 mg/L in some wells, chlorobenzene up to 65 micrograms per liter (ug/L), 1,2,4-trichlorobenzene up to 127 ug/L, and naphthalene up to 55.8 ug/L. DNAPL at the Site is comprised primarily of 1,2,4-trichlorobenzene, naphthalene, and dichlorobenzenes.

The Lagoon material is comprised primarily of naphthalene with lesser amounts of other VOCs and SVOCs. Hexavalent chromium was not found in the Lagoon sludge. Dioxin was detected in some sludge samples.

Chromium slag was used as fill material at the SCCC Site but surface cover of pavement or stone will mitigate potential chromium exposure in the western area of the Site. Total chromium concentrations in soil and sediments at the SCCC Site range up to 34,900 mg/kg in the western



part of the Site and up to 32,600 mg/kg in the eastern part of the Site. Hexavalent chromium concentrations are low in most areas of the Site (below 40 mg/kg).

The primary constituents of concern at the Diamond Site include chromium and hexavalent chromium from the chromite ore process, and DNAPL. Total chromium concentrations in soil and sediments at the SCCC Site range up to 54,000 mg/kg in the eastern part of the Site and up to 8,460 mg/kg in the western part of the Site. Hexavalent chromium concentrations in soil range up to 19,100 mg/kg. The eastern portion of the Diamond Site is paved so there is no exposure to surface soils. Groundwater concentrations of total chromium range up to 77,900 ug/L and up to 86,000 ug/L for hexavalent chromium.

A summary of health hazard data is given in the following sections. **Table 1** presents exposure limits and other properties of chemicals that may be present at this Site.

The main route of exposure for Site chemicals is skin/eye contact and absorption; a second route of exposure is inhalation of vapors/dust. Incidental ingestion is also a possible route of exposure. Potential exposures will be reduced or eliminated by following the work practices and using the PPE designated in this HASP. The overall chemical health hazard assessment for activities covered by this HASP at the Site is low to moderate.

### **3.3.1 VOCs**

The VOCs found on site may irritate skin on contact and irritate the respiratory tract on inhalation. Eye contact may cause eye irritation, burning and inflammation. Ingestion may result in nausea, vomiting, abdominal pain, rapid pulse, respiratory distress and shock. Absorption into the body systems by any route may cause trouble breathing, dizziness, headache, nausea, vomiting, salivation, and convulsions. Overexposure by inhalation may cause drunkenness, drowsiness, incoordination, tremors and restlessness, and an increase in heart rate and pressure. Chronic or long-term effects of overexposure to site constituents may cause dermatitis, and cancer of the liver, kidneys, and respiratory tract.

### **3.3.2 SVOCs/PAHs**

SVOCs found on-site include chlorobenzene, dichlorobenzenes, trichlorobenzene and naphthalene and low concentrations of PAHs. The DNAPL found in monitoring wells is comprised primarily of 1,2,4-trichlorobenzene, naphthalene, and dichlorobenzenes.

Certain high molecular weight polynuclear aromatic hydrogen compounds (PAHs) were found at low concentrations in groundwater. Primary entry routes into the body are inhalation, ingestion, and skin contact. These materials pose less of an inhalation hazard than VOCs because they are less likely to volatilize. However, PAHs can be a potential constituent of airborne dust and pose an inhalation hazard. Inhalation of coal tar constituents and PAHs may irritate the respiratory tract. Eye contact may cause eye irritation, burning and inflammation. Immediate or acute effects from short-term skin exposure to coal tar compounds include irritation; burning, itching, redness, skin color changes, and rashes from skin contact with coal tar compounds.

Photosensitization, a tendency to sunburn more easily or a worsening of rash with exposure to sunlight may occur with skin contact to coal tar compounds. If dust which contains PAHs contacts the skin minor burning and irritation may result, especially with exposure to sunlight. Wash any exposed skin, apply sunscreen (SPF 30), and cover the area with clothing. Skin contact and exposure to coal tar during Site activities can be eliminated by the use of gloves and skin protection.

### **3.3.3 Naphthalene**

High concentrations of naphthalene are found in the Lagoon area at the SCCC Site. Naphthalene is a SVOC and PAH that can cause excitement, confusion, headache, nausea and loss of appetite upon overexposure. The primary routes of entry are inhalation and skin contact.

### **3.3.4 Chromium from Chromite Ore Processing Residue (COPR)**

Chromium may be present on the unpaved portions of the Diamond Site and Western portion of the SCCC Site as total chromium, chromium III, or chromium VI. Chromium and chromium III have relatively low levels of toxicity. Chromium VI, or hexavalent chromium, compounds, particularly chromium oxide, can cause skin, eye and respiratory tract irritation; sometimes severe. Acute overexposure can cause nervous system and liver and kidney damage. Because the highest chromium concentration areas of the SCCC and Diamond Sites are paved or covered with stone there should be little hazard from dust exposure. Drilling and other operations at the Sites should not produce significant amounts of dust that would result in overexposure to chromium or hexavalent chromium.

### **3.3.5 Dioxin**

Dioxin is a common name for 2,3,7,8-tetrachlorodibenzo-p-dioxin or TCDD. In addition to dioxin itself there are other compounds that have similar structures and activity as dioxin. These are commonly referred to as dioxin-like compounds or dioxins. Dioxin concentrations at the SCCC Site are very low and are not anticipated to pose a hazard to workers. However, certain precautions must be taken in the Lagoon area and at the former dichlorobenzene and distillation buildings. See Sections 5.0 and 6.0 for details.

Acute health effects of overexposure to dioxin include irritation of the skin and eyes, headache, weakness, dizziness, nausea and vomiting. Exposure to high concentrations of dioxin or exposure over a long period of time can cause a skin condition called chloracne, reproductive effects, cancer, liver damage, and nervous system damage.

No occupational exposure limits have been established for dioxin. The National Institute for Safety and Health recommends that exposure be limited to the lowest feasible concentration.

Material Safety Data Sheets (MSDSs) for select Site constituents are found in **Appendix A**. Exposure to Site constituents can be avoided or limited by the use of gloves and skin protection. For these reasons, potential exposure risks to Site constituents are considered to be low.

### **3.3.6 Other Hazardous Substances Used at the Site/Hazard Communication**

A list of hazardous chemicals and MSDSs for hazardous chemicals used at the Site by KEY or contractors must be kept at the Site. All containers of hazardous substances must be labeled with the name of the chemical and appropriate hazard warnings. Employees and contractors who use hazardous substances must read the labels and know where MSDSs are located in case of an emergency.

### **3.3.7 Work Task Hazard Assessment**

**Table 1** presents exposure limits and other properties of chemicals that may be present at this Site. More information concerning the health effects of Site chemicals can be found in the Material Safety Data Sheets (MSDS) in **Appendix A**. The overall chemical health hazard assessment for activities at this Site is low. **Table 2** summarizes the chemical hazards associated with Site work tasks, a relative hazard assessment, proposed initial levels of personal protection, and air monitoring requirements.

## **3.4 PHYSICAL HAZARDS**

The primary physical hazards on the Site are those associated with driving and walking around the Site to sample wells, uneven terrain, the Hackensack River, construction equipment and activities, heat stress/cold stress and snow in winter. Safe work practices for these potential hazards are outlined in Section 3.6 (heat stress), Section 3.7, (cold stress) and Section 5.0.

### **3.5     CONFINED SPACES**

Entry into confined spaces is only allowed upon the approval of the KEY Health & Safety Manager. The KEY Health & Safety Manager will determine if entry is necessary and will detail specific entry procedures. KEY and OSHA CSE procedures must be followed, including atmospheric testing of the space and completion of a CSE permit before entry. A minimum of two trained employees must be present for any entry.

### **3.6     HEAT STRESS**

Heat stress may be a concern during warm weather. *Heat cramps* are the least severe form of heat stress, cramps occur due to the depletion of body salts from sweating. *Heat exhaustion* results from significant loss of body salts and fluid. Its symptoms may include weakness or fatigue, nausea, headaches, and in more serious cases, clammy, moist skin with pale or flushed complexion. *Heat stroke* is the most serious heat-related condition and occurs when the body's system to regulate internal temperature fails. Symptoms are hot, dry skin; mental confusion or delirium; convulsions or unconsciousness; and body temperature of 105 degrees Fahrenheit (°F) or higher. In this situation, medical attention is needed immediately; heat stroke may be fatal.

To prevent heat disorders, attention must be paid to such variables as temperature, humidity, air movement, and the physical condition of employees. In addition, breaks must be taken as needed to let the body cool. Liquids designed to replace lost body salts must be provided regularly.

#### **3.6.1   Heat Stress Prevention**

Heat stress can occur even when temperatures are considered moderate. The following recommendations should be followed to help reduce heat stress:

- Personnel must drink plenty of liquids to replace body fluids lost to sweating. To prevent dehydration, personnel should be encouraged to drink generous amounts of

water even if not thirsty. Heat-related problems can happen before the sensation of thirst occurs.

- Cool drinking water, 50°F to 60°F, should be made available to all personnel.
- Only water, or occasionally, electrolyte-balanced drinks, such as Gatorade®, should be used to replace lost fluids due to sweating.
- Beverages containing caffeine, such as colas, coffee, or tea, should be limited or not used because of their diuretic (water depleting) effects.
- Salt tablets should not be used unless prescribed by a physician.
- Self-monitoring of physical condition and buddy monitoring will be essential in order to prevent any heat stress illness. All personnel should be aware of heat stress symptoms and the proper precautions to take if heat stress is observed.
- Rest periods must be provided for all personnel. This means at least 15 minutes in the morning and in the afternoon and at least 30 minutes for lunch. A more frequent rest schedule may be implemented by the SHSO depending on weather conditions and the type of work performed.

### **3.7 COLD STRESS**

Cold weather conditions may result in cold stress ranging from mild frostbite to severe hypothermia. Cold injury and impaired ability to work are dangers at low temperatures and when the wind chill factor is low. Cold stress normally occurs in temperatures at or below freezing, or under certain circumstances, at temperatures of 40 °F. Extreme cold for a short period of time may cause severe injury to exposed body surfaces or result in profound generalized cooling, causing death. Areas of the body that have high surface area to volume ratio, such as fingers, toes and ears, are the most susceptible. Two factors influence the development of a cold weather injury: ambient temperature and wind speed. For instance, 10 °F with a wind of 15 miles per hour is equivalent in chilling effect to still air at -7 °F. A wind chill chart is presented on the following page.

It does not have to be extremely cold for systemic hypothermia to occur. *Hypothermia* may occur at outdoor temperatures approaching 50 °F. Systemic hypothermia occurs when the body core temperature decreases. Symptoms begin with shivering, apathy, loss of coordination, followed by lethargy and coma; if allowed to continue, hypothermia may result in death. Get the victim out of the cold and into dry clothing. Warm up his or her body slowly. Give nothing to

eat or drink until the victim is fully conscious. Warm fluids, but no stimulants such as tea, coffee, alcohol or tobacco should be given. Get medical attention immediately.

*Frostnip*, or incipient frostbite, usually involves the ears, nose, chin, cheeks, and fingertips and toe tips. It occurs during high wind, low temperature, or both. The skin suddenly blanches (becomes white). Frostnip is painless and can be reversed without tissue damage by warming the affected area by using warm water. The area should not be rubbed.

*Superficial frostbite* is a more severe local cold injury. This involves the skin and superficial tissue just beneath it. The skin becomes white, waxy, and firm; the tissue beneath it remains soft. Affected personnel should be taken out of the cold and the affected area slowly and carefully rewarmed. Again, the area should not be rubbed. Stinging and burning may follow warming and superficial blisters may occur.

*Deep frostbite* involves freezing not only of skin and subcutaneous tissue but even muscle and bone. The emergency treatment for deep frostbite is immediate warming. Affected persons should be kept dry, provided with external warming, and the frostbitten part covered by a dressing while being transported promptly to the nearest emergency department. Warm fluids, but no stimulants such as tea, coffee, alcohol or tobacco should be given to frostbite or hypothermia victims.

### **3.7.1 Cold Stress Prevention**

To prevent or minimize the effects of cold stress, the following work practices should be followed:

- Use dry, insulated and/or layered work clothing, warm gloves, hard hat liners, and boots. Combine winter gear with chemical resistant personal protective equipment and waterproof gear to provide the best protection for the given site task and weather conditions.
- Provide rest breaks in warm areas as necessary.
- Use the following wind chill chart to estimate the effects of wind and temperature on the body. Be especially careful to note when frostbite is a potential hazard.

WIND CHILL CHART																		
Wind Speed	Temperature (°F)																	
Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98
Frostbite Times									30 min.	10 min.	5 min.							

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where T = Air Temperature (°F), V = Wind Speed (mph)

From National Oceanographic and Aeronautics Administration and the National Weather Service, 2002

### 3.8 BIOLOGICAL HAZARDS

Biological hazards present at the Site may include poisonous plants, insects, and animals. Poison ivy and poison oak may be present. Contact with the leaves, vine, roots, or sap causes a skin rash on many people. All workers must be familiar with the appearance of poison ivy (three leaves) and wear impervious protective clothing as necessary to prevent contact with poison ivy.

Ticks may be present throughout the Site on brush, grass, and weeds. Some ticks carry disease, such as Lyme disease or Rocky Mountain spotted fever. Wear protective clothing or secure pant legs to lower leg or boot and apply bug repellent to this area. Frequently assist each other in inspecting for ticks. If a tick is found attached to the skin, do not attempt to pick the tick off the skin with fingernails or scrape with a credit card, etc. Carefully remove the tick with tweezers taking care that all parts are removed. Thoroughly scrub the area with soap and water. Save the tick in a small jar or plastic bag and take it to a doctor or health department for identification. If a red circle or rash forms in the area of the tick bite or if flu-like symptoms appear in a few days or weeks consult a doctor for treatment.



A particular hazard at this Site during warmer weather is mosquitoes. Besides the annoyance of the buzzing insects and ordinary mosquito bites, some mosquitoes can transmit West Nile Virus and other diseases. West Nile Virus can be a serious disease, especially for people over 50 years old. Most people have no symptoms after infection but some people have mild symptoms that can include fever, headache, body aches, nausea, vomiting, and swollen lymph glands or a skin rash on the chest, stomach and back. Symptoms last a few days to several weeks. A few people develop severe illness. Symptoms may include high fever, headache, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, vision loss, numbness and paralysis. Symptoms may last several weeks and neurological effects may be permanent. People older than 50 are at a higher risk to get sick, a very few people may die from a West Nile virus infection.

The best way to prevent West Nile Virus is to avoid being bitten by mosquitoes. When working outdoors wears light-colored long sleeve shirts, long pants and socks sprayed with insect repellent. Use repellent carefully! Follow the manufacturer's directions for the repellent you are using. Repellents with DEET (N, N-diethyl-meta-toluamide) or permethrin are effective against mosquitoes and other biting insects. You can use DEET directly on your skin and clothing but do not use on skin under clothing. Use permethrin only on clothing, not directly on skin, and let sprayed clothing dry before use. Repellents with a higher concentration do not mean they work better but that they work longer.

According to the Centers for Disease Control (CDC), a recent study indicated the following:

- A product containing 23.8% DEET provided an average of 5 hours of protection from mosquito bites.
- A product containing 20% DEET provided almost 4 hours of protection.
- A product containing 6.65% DEET provided almost 2 hours of protection.
- Products containing 4.75% DEET and 2% soybean oil were both able to provide roughly 90 minutes of protection.

Sweating or getting wet may mean you need to re-apply repellent more frequently. If possible wash exposed skin before re-applying repellent. Be sure to wash skin that was sprayed with repellent at the end of the day. Wash hands before eating or using the restroom.

Wasps, bees and other stinging insects may also be found at the Site. Use of DEET or repellent containing permethrin will help keep wasps and bees away. However, if a nest is disturbed the repellent will not help. Be alert for bees flying into and out of a particular area, hanging nests, and nests in logs, pipes and other structures. Wear light-colored clothes as darker clothes tend to annoy some stinging insects.

First aid for insect bites and stings includes: applying a baking soda paste or ice wrapped in a wet cloth. Commercial bee sting kits may be helpful. Honeybees leave their stingers in the body; these can be removed by gently scraping the skin, working side to side of the stinger. A bee sting or snake suction device can also be used. If an insect bite becomes red or inflamed or the person becomes dizzy, nauseous, or short of breath then get to medical care immediately.

Avoid unnecessary contact with animals. Some animals may carry disease or poison or may cause injury by biting. If an animal is acting strangely, or if a wild animal approaches humans, leave the area. If necessary, call animal control personnel. Do not try to feed wild animals.

Snakes may also be present on the Site. Leave snakes alone, do not attempt to catch or kill. Stay out of tall grass, brush, and wood or rock piles. Keep hands and feet out of areas you cannot see. If bitten, get the person to medical help immediately. If practical, try to quickly identify the type of snake or at least the color and markings and size. First aid for snake bites includes: Wash the bite with soap and water or antiseptic cleanser, immobilize the bitten area and keep it lower than the heart, cover the area with a clean, cool compress or a moist dressing to minimize pain and swelling. Keep the victim calm and comfortable. If the victim cannot reach medical care within 30 minutes apply a bandage, wrapped 2 to 4 inches above the bite, to help slow the venom. This should not cut off the flow of blood from a vein or artery – the band should be loose enough to slip a finger under it. Without cutting, place a suction device over the bite to help draw venom

out of the wound. Continue alternating suction and application of a compress while transporting to a doctor or hospital. Do not give the victim food or alcohol and only limited other liquids as necessary.

## **4.0 MEDICAL SURVEILLANCE**

All medical examinations and procedures are performed by or under the supervision of a licensed physician at no cost to employees, without loss of pay, and at a reasonable time and place.

### **4.1 PRE-ASSIGNMENT SCREENING**

Employees who perform the work tasks outlined in this HASP must have a current medical screening and approval for work at hazardous waste sites in accordance with 29 CFR 1910.120(f) and the company medical screening policies and procedures. This screening includes:

- Comprehensive medical/occupational history and physical examination;
- Visual acuity and color vision;
- Audiometry (OSHA) - 500, 1000, 2000, 3000, 4000, and 6000 Hz, both ears;
- Complete blood count, including platelets;
- Complete serum profile (including serum chemistry, liver profile and serum lipids);
- Chest X-ray, posterior/anterior view, if not taken in the past three years (results must be available to examining physician), or if indicated by medical necessity;
- Spirometry (pulmonary function test);
- Urinalysis; and
- Electrocardiogram (EKG), if medically necessary.

The physician will provide a written opinion regarding the potential employee's fitness for working at a hazardous waste site, ability to wear a respirator, and any limitations upon the employees assigned work. Employees are furnished a copy of the written opinion, and results of the medical examination and tests upon request.

The company will schedule medical examinations, select appropriate clinics or physicians, review physicians' reports, and maintain employee medical files. Employee medical files are confidential and will not be released without the express written approval of the employee. A copy of all physicians' reports, results and opinions and medical monitoring data will be made available to the employee upon request.

Repeat tests or additional tests or examinations recommended by the physician, based on the initial medical screening and related to the employee's ability to work in hazardous environments, will be arranged by the company.

## **4.2 PERIODIC MEDICAL EXAMINATIONS**

Employees engaged in work with potential exposure to hazardous materials will undergo an annual update of medical and occupational history and an annual physical examination. More frequent medical examinations, consultations, and/or laboratory testing will be provided:

- For employees who, in an emergency situation, may have been exposed to hazardous substances at or near permissible exposure limits (PELs);
- As soon as possible, upon notification by an employee, that the employee has developed signs or symptoms indicating possible overexposure to hazardous substances or health hazards; and,
- If the examining physician determines that an increased frequency of examination is medically required.

The company will arrange for periodic medical examinations and maintain records in the employee's medical file.

## **4.3 MEDICAL RECORDS**

All medical records, including pre-employment medical screening, periodic medical examinations, emergency and non-emergency treatment records, and accident reports, will be maintained in accordance with the following:

- OSHA 29 CFR 1910.1020 - Medical records.
- OSHA 29 CFR 1904 - Injuries, illnesses, and annual summaries.

## **4.4 TERMINATION EXAMINATION**

Upon termination from employment, all employees whose work involved potential exposure to hazardous materials and who have not received a medical examination within the previous six

months will be provided a termination examination. Records of the termination examination will be maintained in accordance with 29 CFR 1910.1020. Employees will be notified regarding termination physical examination requirements.

#### **4.5 SUBCONTRACTORS**

Subcontractors who will perform work at this Site where there is a potential for contact with Site constituents are required to follow the medical surveillance requirements of 29 CFR 1910.120 and a medical surveillance program. Subcontractors who perform work where there is no potential for exposure to Site constituents, are not required to follow the medical surveillance requirements of 29 CFR 1910.120.

#### **4.6 PHYSICIAN'S NAME AND ADDRESS**

Key Environmental Pittsburgh office employees:

Walter W. Hoover, M.D., Medical Director  
Business Fit  
Pittsburgh's Ohio Valley General Hospital  
25 Heckel Road  
McKees Rocks, PA 15136  
(412) 777-6369

Key Environmental Whitehouse, NJ employees:

Eliot Kusnetz, M.D., Medical Director  
Total Care Occupational Medicine  
370 Campus Drive  
Somerset, NJ 08873  
(732) 748-1900

#### **4.7 MEDICAL SURVEILLANCE CERTIFICATION**

I certify that Key Environmental, Inc. employees engaging in on-site activities for more than 30 days or more per year are included in a medical surveillance program as stated above.



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John E. Francis, CIH, CSP  
Health & Safety Manager – Key Environmental, Inc.

## **5.0 WORK PRACTICES AND SITE CONTROL**

### **5.1 ROUTINE SAFE WORK PRACTICES**

Hygienic practices consistent with work hazards are necessary. Eating and food preparation will be prohibited in any area other than those designated and properly protected. Employees who handle potentially contaminated materials or articles will wash with soap or mild detergent and water before eating or using the rest room.

### **5.2 WORK RESTRICTIONS**

All outdoor work at the Site must be conducted during daylight hours unless adequate lighting is provided. Outdoor work must cease immediately upon the signs of impending thunderstorms and lightning or other severe weather, as determined by the SHSO.

### **5.3 CLEARING AND GRUBBING**

Brush clearing operations may involve the use of a brush hog, bulldozer, chain saw, weed cutter and other equipment. Employees must follow the manufacturer's operation and safety recommendations for all equipment used. Wear eye protection, hearing protection, gloves, safety boots and adequate clothing to prevent lacerations and abrasions. Do not wear loose clothing or jewelry that could get caught in the chain or cutting edges. Avoid poison ivy when possible and wear protective clothing and boots and wash thoroughly after clearing to reduce the potential for contracting a rash from poison ivy. Be alert for snakes, bees, and other hazards while clearing. Store gasoline in approved safety cans and be careful when refueling gasoline powered tools. Gasoline is extremely flammable; the engine should be stopped and cooled before refueling. Do not spill fuel when refueling.



## **5.4 UNDERGROUND AND OVERHEAD UTILITIES**

Underground utilities and pipelines can present special hazards such as electrocution, sudden release of pressure (gas or liquid), and explosion and fire. Underground installations such as sewer, fuel, natural gas, electrical, water, and other lines as well as underground tanks must be identified and marked before and digging, drilling or excavation. Activities covered by the New Jersey One-Call System include, but are not limited to, excavations or trenching, blasting, installation of tents, sign posts or fence posts, and removing or planting of trees. Obtain plant information such as drawings, etc. as to the location of underground utilities, tanks, etc. Contact New Jersey One-Call at (800) 272-1000 at least three full working days, but not more than ten days before the planned start of underground work.

Be prepared to give the one-call agency the name and address of the site; the nearest cross street; and the date of the intended excavation or drilling. The one-call agency will provide a reference number for the site - mark this down for future referral. There should also be an associated expiration date for the work, make sure this is recorded also and keep it available during field work. Inquire as to which utilities and/or companies will be contacted by the agency. It is the responsibility of the company/person doing the underground work to notify any utilities and/or companies that the one-call agency does not.

Utility location agencies generally do not contact water and sewer departments that are often part of the local public works department. These must be contacted directly by the company/person performing the underground work. Ask the utility location service and/or public works department to mark-out private hook-ups from the main line to the property. These may not be marked unless you specifically ask them to do so. If additional excavation or drilling is needed at the site and these fall outside the original area described to the one-call agency contact the agency again. Also, if the work is scheduled to take place outside the one-call expiration date then the agency must be contacted again (refer to the original site number).

Never take the exact location of even marked utilities for granted. Begin each excavation or borehole slowly and cautiously, taking care to check for the presence of structures or lines for at least the first three feet of depth. In some cases hand augering and probing with a non-conductive probe may be necessary.

Check for any overhead wires before work. Keep equipment at least 20 feet away from overhead lines.

## **5.5 OPERATING HAZARDS**

Operating hazards during construction activities may include work near construction and heavy equipment use, noise, electrical equipment and power lines, and excavations. The employees who are most at risk of being injured are individuals unfamiliar with the site and/or construction equipment. The initial site orientation by the Construction Contractor should include a review of the equipment to be used on-site, operating hazards and precautions, and the assignment of only trained and qualified personnel to operate equipment. KEY personnel are not permitted to operate heavy equipment.

### *Working Near Construction Equipment*

- Never stand directly in front of a backhoe or front end loader; the operator cannot see you.
- Never stand or walk under a backhoe shovel or crane boom.
- Never walk or stand under loading or unloading equipment (i.e., when you are in an excavation). Also beware that equipment such as cranes and trucks with hydraulic lift beds can tip. Avoid standing next to them when in use.
- Wear light or brightly colored clothing. This may include safety vests.
- Maintain visual contact with machine operators. Coordinate with the operators a safe place to stand when you are not directly involved with site activities such as sampling or air monitoring.
- Prearrange a hand signal communication system with machine operators. The use of whistles, hand radios, and horns to communicate is also appropriate.
- If you are not familiar with the hand signals to guide heavy equipment operations or cranes do not attempt to direct their activities. Only trained signal persons may direct crane and other activities that use specialized hand signals.
- Two or more people should not simultaneously climb a ladder or access/egress ramp.

- Communicate with machine operators to ensure that your means of access/egress is not blocked by the equipment.

#### *Noise*

- Wear hearing protection as required by facility rules and in any marked area requiring hearing protection.
- Wear hearing protection while operating or working near heavy equipment, drill rigs, power tools, etc.
- A field rule is to use hearing protection if you cannot hear normal conversation within an arms length of the person talking.
- Wear hearing protection if sound levels exceed those shown on the following table:

<b>Duration per day, hours</b>	<b>Sound level, dBA slow response</b>
8	85
4	90
2	95
1	100
½	105
¼	110
Impact noise	140

#### *Electrical Hazards*

Overhead power lines, downed electrical wires, and buried cables all pose a danger of shock or electrocution if workers contact or sever them during site operations. Electrical equipment used on site may also pose a hazard to workers.

- Use low voltage equipment equipped with ground fault circuit interrupters and corrosion resistant connection cables while working on site.
- Inspect all electrical equipment periodically to ensure that the ground pathway is in working order.
- Monitor weather conditions and suspend work during electrical storms.
- Ground and discharge capacitors and other electrical equipment that may retain a charge before handling.

#### *Excavations*

To avoid cave-ins, excavation/trenching preplanning is of the utmost importance. Factors to be consider these items when planning any excavation or trenching operation:

- Location of underground utilities
- Soil type
- Soil moisture
- Previous soil disturbance
- Size and depth of excavation
- Length of time that excavation will be opened
- Weather conditions
- Type of excavation equipment
- Distance from excavation to existing structures
- Type and quantity of traffic in the vicinity of the excavation
- Possible sources of shock and vibration near the excavation
- Need for shoring.

## **5.6 DRILLING**

Monitoring wells, piezometers, pumping wells and DNAPL recovery wells will be installed, abandoned or refurbished during this project. Personnel working on or near drill rigs must be aware of the hazards of drilling activities and rotating parts used in the drilling process.

- Clear away all debris from the immediate area
- Be sure that the area to be drilled is free of underground power lines, gas lines, water mains, sewers, or other utilities.
- Before erecting the derrick, be sure that there are no overhead power lines, tree branches, or other obstructions in the path.
- Stay a safe distance from the lines being used for hoisting and pulling. Never straddle or reach across them.
- Always stand clear of the cable, hoisting plug, and rods while the operator releases the tension on the cable. The bail or hoisting plug may spin rapidly when the tension is released.
- Never place a hand on the guide or drive head when the drive hammer is suspended or in use. Many hand injuries around drill rigs occur in this fashion.

## **5.7 OPENING WELLS AND PIEZOMETERS**

Opening wells and piezometers may release vapors of potentially hazardous site constituents that have concentrated in the headspace of wells. Precautions to prevent exposure include:

- Open wells carefully and allow to vent before taking measurements or sampling.
- Stand to the side and avert face when opening wells.

## **5.8 EXCAVATION AND TRENCHING - GENERAL**

Excavation and trenching are major hazards of construction; a number of precautions must be taken to prevent cave-ins or other accidents. An excavation is defined as any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal. A trench is a narrow excavation. In general, the depth of a trench is greater than the width, but the width of a trench (at the bottom) is not greater than 15 feet.

The following site conditions must be taken into account when planning excavation work:

- Traffic
- Nearness to structures and their condition
- Soil type
- Surface and groundwater
- Depth to water table
- Overhead and underground utilities
- Weather

All excavations must be dug in accordance with OSHA 29 CFR 1926, Subpart P, "Excavation, Trenching, and Shoring." The following is a summary of excavation requirements:

- Determine the exact location of underground utilities before excavation. While the excavation is open protect, support, or remove the underground installation as necessary to safeguard personnel.
- All surface encumbrances (e.g., trees, boulders, etc.) must be removed or supported if they present a hazard to employees. Surface encumbrances can collapse on employees when undermined by excavation activities and can also interfere with traffic.

- Use support systems to ensure the stability of adjacent structures if necessary.
- Employees exposed to vehicular traffic must wear warning vests made of reflective or high visibility material.
- Water must not be allowed to accumulate in excavations. Water can lead to cave-ins.
- Employees must not work on faces of sloped or benched excavations at levels above other employees unless the employees at the lower level are protected from the hazard of falling, rolling, or sliding material or equipment.
- Personnel are not permitted on the downgradient side of heavy equipment when operating on a grade. A safe pathway must be determined before moving equipment from one location to another.
- Employees are not permitted under loads handled by lifting or excavation equipment. To avoid being struck by debris employees must also stand clear of trucks being loaded or unloaded.
- If a machine operator does not have a clear view of an excavations edge a warning system such as barricades or hand signals must be used to ensure that equipment does not fall into the excavation.
- Walkways must be provided where employees or equipment are required to cross excavations. Standard guardrails must be provided where walkways are 6 feet or more above the lower level.

IF PERSONNEL ARE TO ENTER AN EXCAVATION OR TRENCH:

- The sides of trenches greater than 5 feet deep must be shored, unless they are sloped to the angle of repose, or unless the trench is in solid rock. Check the OSHA standard 29 CFR 1926.650-652 and Appendices for appropriate requirements depending on soil type. Soil classification must be performed when designing a sloping or benching system. Shoring must be adequate to prevent wall collapse in whatever soil condition encountered.
- Excavations more than 20 feet deep must be designed by a registered professional engineer.
- Trenches or excavations 4 feet deep or deeper must be provided with a means of entering and exiting (i.e., ramps or ladders). A worker must not be more than 25 feet away from a means of exit. Ladders must extend from the bottom of the trench to at least 3 feet above the surface of the ground.
- The atmosphere of any excavation 4 feet or deeper must be tested for oxygen content, flammable gas, and other potential hazardous substances before employees may enter if a hazardous atmosphere or lack of oxygen can reasonably be expected.
- Emergency equipment, such as breathing apparatus, a safety harness and line, or a basket stretcher, must be readily available where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in the excavation. This equipment must be attended while in use.
- Employees must be protected from loose rock or soil that could pose a hazard by falling or rolling from an excavation face.

- Employees must be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Materials and equipment must be kept at least two feet from the edge of the excavation, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations.
- Water must not be allowed to accumulate in excavations; water can lead to cave-ins.
- Daily inspections of the excavation, adjacent areas, and protective systems must be made by a competent person for evidence of a situation that could result in possible cave-ins, failures of protective systems and equipment, hazardous atmospheres, or other hazardous conditions. Inspections are required before the start of work and as needed throughout the shift and after every rainstorm or other hazard-increasing occurrence. Inspections are only required when employee exposure to hazards is reasonable anticipated.
- If the competent person finds evidence of a dangerous situation, employees must be removed from the hazardous area until precautions are taken to protect employees.
- Additional information on soil classification, slope configuration, timber shoring, aluminum hydraulic shoring, and other alternatives are found in Appendix A through E at the end of the OSHA excavation standard 29 CFR 1926.650-652.

KEY personnel will not be in direct control of excavation and trenching activities and will not act as the “Competent Person” for excavation and trenching. The Construction Contractor must provide the Competent Person for excavation and trenching and follow OSHA and other appropriate requirements for excavation and trenching.

## **5.9 SHEET PILE WALL INSTALLATION**

Potential hazards during installation of the sheet pile wall include, but are not limited to: heavy equipment operation including crane use; truck traffic across the Site and in the work area; struck by or caught between sheets and frames; personnel or equipment falling into the starter trench; noise exposure; drowning; hypothermia; and a low potential exposure to Site constituents including SVOCs.

Personnel must keep aware of all heavy equipment and traffic movements; anyone directing cranes or heavy equipment must know the proper hand signals; all personnel in the work area must keep aware of crane and heavy equipment swing radius and stay out of the way; non-essential personnel must stay clear of the operations; excavations must not be entered unless the

excavation is properly sloped or shored; if working along the edge of the water, personnel must wear Coast Guard approved personal flotation devices, have a life ring immediately available and keep an emergency boat immediately available; and air monitoring must be performed in accordance with Section 7.0 of this HASP.

## **5.10 SLURRY WALL INSTALLATION**

The slurry wall will be a narrow trench of varying depth around the Site filled with the slurry and backfill material. No personnel will enter the trench. An excavator, bulldozer and other heavy equipment will be used to construct the slurry wall.

Potential hazards include overhead and underground utilities; caught between or contact with moving equipment; personnel or equipment falling into the excavation; noise exposure; and potential inhalation and skin exposure to VOCs and PAHs and hexavalent chromium in some areas. Follow the precautions in previous sections for heavy equipment and excavation safety. Ensure that personnel and equipment is kept at least two feet away from the edge, and more as necessary, to avoid collapse of the excavation. Monitor for VOCs and dust as outlined in Section 7.0. Dust will be controlled to reduce or eliminate potential exposure to SVOCs and chromium.

## **5.11 CONSTRUCTION OF GROUNDWATER RECOVERY AND TREATMENT SYSTEM AND DNAPL RECOVERY SYSTEM**

Construction of the hydraulic control pump and treatment system, DNAPL recovery system and lagoon dewatering system will involve many mechanical and electrical components. Personnel must use tools and equipment in accordance with manufacturer's instructions good construction practice; also follow the tool safety and electrical safety guidelines below. Hazards encountered during installation of equipment may include lacerations, abrasions, contusions, and back and muscle strain. Wear Level D protection at a minimum and use work gloves as needed. Operation of the hydraulic pump and treat system will involve the use of treatment chemicals. Because not all operating parameters will be finalized for the pump and treat system until



additional sampling and analysis is performed this HASP does not cover start-up and operation of this treatment system.

## **5.12 ELECTRICAL SAFETY AND LOCKOUT/TAGOUT**

### Electrical Safety-related Work Practices

- Only qualified persons may work on or near exposed, energized electrical parts.
- No employee is permitted to work in such proximity to any part of an electric power circuit that the employee could contact the circuit in the course of work, unless the employee is protected against electric shock by deenergizing the circuit and grounding it or by guarding it effectively by insulation or other means, or unless the employee is trained as a qualified person (electrical training and experience).
- Working spaces, walkways, and similar locations must be kept clear of cords so as not to create a hazard to employees.
- No changes in circuit protection are allowed to increase the load in excess of the load rating of the circuit wiring.
- Extension cords must not be fastened with staples, hung from nails, or suspended by wire.
- Portable lighting, or other electric equipment, used in wet or conductive locations, must be operated at no more than 12 volts or must be protected by ground-fault circuit interrupters (GFCIs).
- Worn or frayed electrical cords or cables must not be used.
- Extension cords must be of the three-wire type. Extension cords used with temporary or portable equipment must be designed for hard or extra-hard usage (for example, Types S, SD, and SO).
- Electric equipment and lines must be considered energized until determined otherwise by testing, or until grounded.
- Operating voltage of equipment and lines must be determined before working on or near energized parts.
- All electric tools must be either three prong, grounded, double insulated, or rechargeable battery type.

- Portable ladders must have non-conductive side rails in situations where the employee or the ladder could contact exposed energized parts.
- All work on electrical equipment must be performed strictly in accordance with lockout/tagout procedures. Lockout/tagout rules apply to energized and deenergized electrical equipment.
- Verification of deenergization is mandatory and must be performed by a qualified person.
- Reenergization must be performed by a qualified and authorized person, and all employees in the area must be warned that reenergization is being performed.

### **Lockout/Tagout**

Lockout/tagout refers to the control of hazardous energy by a system of positive control (locks) and warning labels (tags). All energized equipment must be deenergized and locked out and tagged before repairs or maintenance is performed on the equipment (except for equipment that is designed to be maintained while in operation). Specific lockout/tagout procedures have been developed and for all energized equipment associated with the pump and treat system. These procedures identify the piece of equipment and all energy sources associated with the equipment; explain how to lock out the equipment, and how to safely reenergize equipment. The lockout procedures are found in Appendix B and follow these general steps:

- Step 1 - Notify Affected Employees
- Step 2 - Prepare for Shutdown
- Step 3 - Shutdown the Machine/Equipment
- Step 4 - Isolate the Machine/Equipment from All Energy Sources
- Step 5 - Apply the Lockout/Tagout Device
- Step 6 - Release/Disconnect Any Stored Energy
- Step 7 - Verify Isolation
- Step 8 - Perform Task
- Step 9 - Release from Lockout or Tagout

### **5.13 HAND AND POWER TOOL SAFETY**

The following are general guidelines to prevent accidents while using hand and power tools when working on treatment system equipment:

- Inspect each tool for damage before use;
- Use the right tool for the job;
- Operate tools according to manufacturer's instructions;
- Keep tools in good working condition with proper maintenance;
- Use the proper protective equipment; and
- Do not use "cheater bars" to exceed the design capacity of the tool.

Power tools include electric, pneumatic, liquid fuel, and hydraulic tools. General safety precautions for these tools include:

- Never carry a power tool by the cord or hose;
- Never yank the tool's cord or hose to disconnect from a receptacle;
- Keep cords and hoses away from heat, oil, and sharp edges;
- Disconnect tools when not in use, before servicing, and when changing accessories (i.e., blades, bits, cutters);
- Secure work items with clamps or vises to keep both hands free to operate the tool;
- Maintain good footing and balance during operation of tools;
- Never leave tools, electrical cords, or hoses where they might create a tripping hazard;
- Keep tool guards in place at all times;
- Use double insulated, three wire grounded plugs, or low voltage electric tools to prevent shock;
- Use ground fault circuit interrupters (GFCIs) for portable electric tools and when running any electric extension cords outside the building;
- Perform maintenance routinely.

## **5.14 LAGOON DEWATERING AND BACKFILLING**

Lagoon dewatering will involve pumping water from the lagoon to an on-site treatment system. Clean borrow materials or uncompacted Site soils will be used for backfill for the lagoon. Exposure to SVOCs in water and sediments must be minimized through work practices and use of PPE. Workers must wear nitrile gloves when there will be contact with the lagoon water or sediments. Although the sediment will be wet dust control must be used on surrounding soil to minimize the potential for exposure to Site constituents when heavy equipment is in use. Dust monitoring must be performed in the area to ensure dust control.

## **5.15 REMOVAL OF NEAR-SHORE SEDIMENTS**

Removal of near-shore sediments includes the use of an excavator sitting on shore reaching out 50 feet into the river to remove sediments to a maximum depth of three feet. Gravity, mechanical or conditioning agents will be used for dewatering and soils will be stockpiled for future use or disposal. Potential hazards include working near water; equipment operating hazards; truck traffic across the Site and in the work area; struck by or caught between equipment; personnel or equipment falling into the river; noise exposure; drowning; hypothermia; and a low potential exposure to Site constituents including SVOCs.

Personnel must keep aware of all heavy equipment and traffic movements; anyone directing the equipment must know the proper hand signals; all personnel in the work area must keep aware of the excavator swing radius and stay out of the way; non-essential personnel must stay clear of the operations; if working along the edge of the water, personnel must wear Coast Guard approved personal flotation devices, have a life ring immediately available and keep an emergency boat immediately available.

### **5.1.6 INSTALLATION OF SURFACE COVER AND ASSOCIATED STORMWATER CONTROLS**

Installation of surface cover may generate dust that must be controlled to minimize potential exposure to hexavalent chromium in soils. Personnel exposure monitoring for hexavalent chromium must be performed in potential chromium soil areas. Follow control measure for working with heavy equipment and vehicle traffic.

## **5.17 SLIP, TRIP, FALL**

Hazards throughout the Site include uneven terrain, holes, ditches, unstable slopes, slippery surfaces, unmarked projections, and ground debris that can cause employees to trip and fall. Sediment and surface water sampling in the river requires walking down slopes and walking on the river sediment. Take care to notice and avoid unsafe site conditions.

- Visually examine slopes for stability;
- Test your footing;
- Take sure the walking/work area is adequately lit;
- Be aware of ground debris; remove broken glass, nails, wire, and other debris if possible, or mark off and avoid areas of heavy debris.

## **5.18 WORKING OVER OR NEAR WATER**

- Employees who work over or near water where the danger of drowning exists must wear U.S. Coast Guard-approved life jackets.
- Inspect life jackets before and after each use for defects which could alter their strength and buoyancy.
- Ring buoys with at least 90 feet of line must be provided and readily available for emergency rescue operations. Distance between ring buoys must not exceed 200 feet.
- At least one lifesaving skiff must be immediately available at locations where employees are working over or adjacent to water.
- Keep an emergency horn or radio immediately available.
- Make sure that others in the area know of the planned activities and are alert for potential emergencies.
- All personnel must know the signs and symptoms of hypothermia in case someone falls into the water.

Working on a boat can present many hazards such as falling in the water; drowning; slips, trips and falls; onset of severe weather while on the water; and an accident with another vessel. To prevent or control such hazards use the following precautions:

- Wear approved personal flotation devices;
- Use the buddy system for warning of danger;
- Have a life-ring or buoy immediately available (on boat and on shore);
- Keep an emergency air horn available;
- Ensure the deck of the boat is clear of debris and not slippery; and,
- Monitor the weather radio, track tides and other water movements.

## **5.19 DUST CONTROL**

When dust generating activities are performed dust control must be achieved with a combination of work practice and engineering controls. Work practices to control exposure to dust include working upwind when possible, limiting the speed of vehicle travel at the Site, and using care to limit excess dust during construction activities. Engineering controls used may include water spray or other methods to keep dust down.

## **5.20 ODOR CONTROL**

Odor control techniques may be employed in combination with dust control methods to reduce or prevent on- and off-site emission of dust, vapors and odors to protect workers and the public. The techniques may include the use of work practice controls such as maintaining low on-site traffic speeds; controlled excavation and material handling methods; the use of a non-hardening, aqueous, biodegradable foam; and the use of an aqueous biodegradable vapor suppression agent.

Work activities that may generate odors include:

- Hackensack River dike extension mat and sediment excavation and dredging;
- Excavation of the lagoon;
- Waste pile consolidation and/or solidification; and,
- Management of spoils from slurry/barrier wall construction.

Odor control options include:

- Limiting vehicle speed on-site;
- Limiting the areas of open excavation;
- Minimizing spillage and overhandling of materials;
- Controlled dumping/movement of excavated material;
- Site dust control with water mist;
- Work timing – early day best for moving materials, avoid or reduce work during high wind conditions;
- Covering potential odor generating materials with vapor suppression foam of and odor suppression agent;
- Covering excavated material in bucket and trucks with foam or odor suppression agent; and,

- Using foam of odor suppression agent to control odors during the mixing and conditioning of work piles.

## **5.21 HOT WORK**

Hot work will not be performed by KEY personnel. If a KEY subcontractor needs to perform hot work, then all hot work will be performed by authorized personnel in accordance with a hot work permit.

- Remove, shield, or cover with noncombustible material all flammable or combustible materials within 35 feet of hot work. Clean the work piece of oil, grease, paint, or chemical residue. Remove any combustible floor debris.
- No hot work may be performed in areas where flammable paints or other flammable materials or heavy concentrations of dust may create a hazard.
- Test the oxygen content and LEL before performing hot work in confined spaces, trenches or other areas where flammable gases may accumulate.
- Provide a fire watch person for the duration of the hot work (if all fire precautions cannot be maintained), and for 30 minutes after the completion of work.
- Provide fire extinguishing equipment for use while hot work is performed.
- Post warning signs around the area of hot work.
- Use the appropriate ventilation, welding helmets and goggles, respiratory protection, and other PPE to protect from air contaminants, sparks, welding rays, and other hazards involved with the specific welding job.
- Protect yourself and others from hot and/or falling objects while cutting or welding by supporting the object to be worked on, changing procedures, or tying off the work with noncombustible line.
- Tanks, drums piping, or other containers must be emptied and cleaned thoroughly, disconnected or blanked, and vented or purged before performing hot work.
- For work in confined spaces follow confined space entry procedures and permit requirements as well as hot work procedures. Ventilate the space or use airline respirators, continuously monitor the atmosphere for oxygen and flammables, keep compressed gas cylinders outside the space, and shut off the gas supply to torches outside the space and remove the hoses when not in the space.

## **5.22 SITE ACCESS/SITE CONTROL**

### **5.22.1 Site Access**

Access to the Site is from Belleville Turnpike via a gate. The Site is fenced along its perimeter.

### **5.22.2 Work Zones**

Site work zones will be determined by the Construction Contractor for their work. For any work performed by the KEY representative(s), the work zone will be the immediate area surrounding their work activities. Separate Exclusion Zone and Decontamination Zone areas will not be necessary for the KEY representative(s) work. KEY personnel will warn outsiders away from work activities as necessary. In general, decontamination will consist of removing and disposing of nitrile gloves used during sampling and other activities. For other than routine tasks the possibility of exposure or transfer of contaminated substances will be reduced or eliminated in a number of ways, such as the following as appropriate:

- Setting up barriers to exclude personnel from contaminated areas;
- Minimizing the number of personnel and equipment at the Site;
- Establishing work zones within the Site;
- Establishing control points with regular access to and egress from work zones;
- Conducting operations in a manner to reduce exposure of personnel and equipment;
- and,
- Implementing appropriate decontamination procedures.

KEY personnel will abide by the work zone restrictions and rules established by the Construction Contractor when working in the Construction Contractor work areas.

### **5.23 SITE HOUSEKEEPING**

All equipment and materials carried to sampling locations will be carried out. Used disposable clothing and equipment will be placed in plastic bags immediately upon removal and the bags closed. PPE may be placed in a drum for subsequent disposal.



## **5.24 SANITATION/CHANGING FACILITIES**

A portable toilet will be located near the Site trailer and hand sanitizer will be available. Potable water will be available in jugs at the Site.

## **5.25 CONTAMINATION AND EXPOSURE PREVENTION**

Personnel must wear Level D protection at a minimum and upgrade as necessary. Personnel must not walk in areas with potential Site constituents unless necessary and stay upwind of operations when feasible.

## **5.26 SITE COMMUNICATIONS**

- Telephones - A cell phone will be used for on-Site and off-Site communication.

## **6.0 PERSONAL PROTECTIVE EQUIPMENT**

The objective of the protective equipment (PPE) program is to protect employees from safety and health hazards present at the Site and to prevent injury to workers from incorrect use and/or malfunction of PPE. No single combination of protective equipment and clothing is capable of protection against all hazards. PPE must be used in conjunction with safe work practices, decontamination, and good personal hygiene.

### **6.1 SITE-SPECIFIC LEVELS OF PROTECTION**

The level of protection for most Site activities will be Level D or a modified Level D. Level D will consist of:

- Long or short-sleeve shirts and long pants;
- Appropriate gloves for material handling activities, as needed. Use nitrile gloves when handling soil or groundwater that may contain Site constituents;
- Steel-toe and shank safety boots;
- Hard hat;
- Safety glasses with side shields; and,
- Hearing protection as required.

Modified Level D will consist of Level D as above plus:

- Regular or polycoated Tyvek (or similar material) as necessary to prevent skin contact;
- Nitrile gloves; and,
- Nitrile or other chemically resistant overboots.

### **6.2 UPGRADE CONDITIONS**

If conditions should change where there is a possibility of overexposure to dust, dust suppression techniques must be used, or employees should work upwind to reduce potential exposures. If these measures do not reduce dust concentrations below the acceptable limits set forth in Section 7.0, then the level of protection will be upgraded to Level C as necessary

Level C protection will consist of:

- NIOSH-approved half or full-face, air-purifying respirator equipped with appropriate combination organic vapor and P100 dust cartridges. Dust-resistant safety goggles will be required if half-face respirators are worn. Beards that interfere with respirator fit are not allowed for field personnel that will be required to wear a respirator. Respirator cartridges must be changed at the end of each work shift and new cartridges installed before the next shift when respirators are required. Respirator cartridges also must be changed if breathing becomes difficult or if the filters become wetted.
- Chemical-resistant clothing over work clothes, regular Tyvek®, or polycoated Tyvek®, as necessary.
- Nitrile outer gloves and nitrile inner gloves.
- Steel-toe, steel shank safety boots with nitrile, butyl rubber or neoprene chemical-resistant outer boots.
- Hard hat.
- Hearing protection as required.

Organic vapor respirator cartridges may be used for one 8-hour shift only. Once a respirator cartridge is removed from the manufacturer's sealed bag it must be used or discarded.

Level B protection is not expected to be necessary during Site activities. The SHSO has the responsibility for monitoring Site and work task conditions and deciding the appropriate level of protection based on the air monitoring guidelines presented in Section 7.0 and any other indications of potential exposure.

### **6.3 PPE USE AND LIMITATIONS**

PPE is selected to protect employees from the specific hazards that they are likely to encounter during their work on site. Selection of appropriate PPE is a complex process that must take into consideration a variety of factors. Key factors involved in this process are:

- Hazard identification;
- Potential exposure routes;
- Performance of PPE materials;
- Work tasks to be performed:
  - Durability of PPE;

- Heat stress and task duration; and,
- Matching of PPE to work tasks.

The more that is known about site hazards, the easier the job of PPE selection becomes. As more information about site hazards becomes available, the PSHO or SHSO can make decisions to upgrade or downgrade the level of protection to match the tasks at hand. PPE selection, evaluation, and re-selection is an ongoing process.

The following are guidelines for the selection of appropriate PPE. Site-specific information may suggest the use of combinations of PPE selected from the different levels described below as being more suitable to the hazards of the work.

### **Levels of Protection - Selection Criteria and Description of Categories**

Levels of protection have been divided into four categories based on the degree of protection afforded:

#### ***Level A***

Level A protection is selected when the greatest level of skin, respiratory, and eye protection is required. Level A should be used when:

- The hazardous substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system (based on measured or potential concentrations and work functions involving a high potential for splash, immersion, or exposure)
- Substances with a high degree of hazard to the skin or are capable of being absorbed through intact skin are known or suspected to be present
- Operations must be conducted in confined, poorly ventilated areas where the absence of conditions requiring Level A has not yet been determined.

Level A equipment includes:

1. Pressure-demand, full facepiece, self-contained breathing apparatus (SCBA), or pressure-demand supplied-air respirator (SAR) with escape SCBA (NIOSH approved);
2. Totally encapsulating chemical-protective suit;
3. Coveralls\*;
4. Long underwear\*;

5. Chemical-resistant outer gloves;
6. Chemical-resistant inner gloves;
7. Chemical-resistant steel toe and shank boots;
8. Hard hat (under suit)\*;
9. Disposable protective suit, gloves, and boot covers (may be worn over totally-encapsulating suit)\*; and,
10. Two way radios (worn inside encapsulating suit).

\*Optional; as applicable.

### **Level B**

Level B is selected when the highest level of respiratory protection is necessary but a lesser level of skin protection is required. Level B should be used when:

- The type and atmospheric concentration of substances have been identified and require a high level of respiratory protection but less skin protection;

(NOTE: This involves atmospheres with IDLH concentrations of specific substances that do not present a severe skin hazard or do not meet the criteria for air purifying respirators.)

- The atmosphere contains less than 19.5 percent oxygen;
- Direct-reading instruments or organic vapor monitors detect the presence of high levels of incompletely identified gases or vapors that are not suspected to be harmful to or absorbed by the skin; and,
- When entering an uncontrolled hazardous waste site where airborne contaminant concentrations are unknown. (Note: This is minimum requirement under OSHA regulations. Level A may also be used in this situation).

Level B equipment includes:

- 1 SCBA or pressure-demand SAR with escape SCBA;
- 2 Hooded chemical-resistant clothing (coveralls; one or two piece chemical-splash suit; disposable chemical-resistant coveralls);
- 3 Coveralls\*;
- 4 Chemical-resistant outer gloves;
- 5 Chemical-resistant inner gloves;
- 6 Chemical-resistant steel toe and shank boots;
- 7 Disposable boot covers, chemical-resistant\*;
- 8 Hard hat;
- 9 Two way radios; and,
- 10 Face shield.\*.

\*Optional; as applicable.

### ***Level C***

Level C is selected when the concentration(s) and type(s) of airborne contaminants are known and the criteria for use of air purifying respirators are met. Level C should be used when:

- The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect or be absorbed through any exposed skin;
- The types and concentrations of air contaminants have been identified and a canister or cartridge respirator is available that is capable of removing the contaminants; and,
- All criteria for the use of air purifying respirators are met (see Section 14.2.1.1).

Level C equipment includes:

1. Full-face or half-mask air purifying canister-equipped respirators (NIOSH-approved);
2. Hooded, chemical-resistant clothing;
3. Coveralls\*;
4. Chemical-resistant outer gloves;
5. Chemical-resistant inner gloves;
6. Chemical-resistant steel toe and shank boots\*;
7. Chemical-resistant disposable boot covers\*;
8. Safety glasses with sideshields (or chemical splash goggles\*);
9. Hard hat;
10. Escape respirator\*;
11. Two way radios; and,
12. Face shield.\*.

\*Optional; as applicable.

### ***Level D***

Level D is primarily a work uniform affording minimal protection. It should be worn only in areas where there is no possibility of contact with contamination. Level D protection should be used when:

- The atmosphere contains no known hazard; and,
- Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.

Level D equipment includes:

1. Coveralls/work clothes;
2. Gloves\*;
3. Boots/shoes, leather or chemical-resistant, with steel toes and shanks;
4. Chemical-resistant disposable outer boots\*;
5. Safety glasses with sideshields (or chemical splash goggles\*);
6. Hard hat;
7. Escape respirator\*; and,
8. Face shield.\*.

\*Optional; if applicable.

Combinations of PPE other than those described for Levels A, B, C, or D protection may be more appropriate and may be used to provide the proper level of protection.

Facial hair, long hair or stubble that may interfere with the sealing surface of a respirator is prohibited. Eyeglasses with temple pieces may not be used with respirators; a compatible spectacle kit and lenses must be worn. There is to be no gum or tobacco chewing during respirator use.

#### **6.4 WORK MISSION DURATION**

Before workers actually begin work in their PPE ensembles, the anticipated duration of the work mission will be established. Several factors may limit mission length. These include:

- Oxygen/air supply consumption.
- Suit/ensemble penetration/permeation.
- Coolant supply.
- Ambient temperature.

For this project daily work mission length is expected to be 8 to 10 hours in Level D protection.

Work missions may be shortened to include a 15-minute rest period every two hours if Level C protection is used. Also refer to Section 3.6, Heat Stress for further restrictions if heat stress may be an issue during the project duration.

## **6.5 PPE MAINTENANCE AND STORAGE**

For this Site there is little maintenance required for Level D PPE to be used. Protective clothing and gloves are disposable; safety glasses, hard hats, and safety shoes are able to be washed clean with detergent and water. Respirators will be disassembled and cleaned and stored per manufacturer's instructions.

Clothing that will be reused must be stored properly to prevent damage or malfunction from exposure to dust, moisture, sunlight, damaging chemicals, extreme temperatures and impact. Some guidelines for general storage of chemical protective clothing include:

- Potentially contaminated clothing should be stored in an area separate from street clothing or unused protective clothing.
- Potentially contaminated clothing should be stored in a well-ventilated area, with good air flow around each item, if possible.
- Different types and materials of clothing and gloves should be stored separately to prevent issuing the wrong material by mistake (e.g. many glove materials are black and cannot be identified by appearance alone).
- Protective clothing should be folded or hung in accordance with manufacturer instructions.

## **6.6 PPE TRAINING AND PROPER FITTING**

Workers are trained in the proper use and fitting of PPE during the initial 40-hour hazardous waste course. This training is re-emphasized during the annual 8-hour refresher training. In addition, at the start of the project employees are reminded of the proper fitting of PPE for the tasks to be performed. If respirators may be used during a project workers are also trained according to the OSHA respiratory protection standard, 29 CFR 1910.134.

At a minimum the training points out the user's responsibilities and explains the following, using both classroom and field training when necessary, as follows:

- The proper use and maintenance of selected protective clothing, including capabilities and limitations.
- The nature of the hazards and the consequences of not using the protective clothing.
- The human factors influencing protective clothing performance.



- Instructions in inspecting, donning, checking, fitting, and using protective clothing.
- Use of protective clothing in normal air for a long familiarity period.
- The user's responsibility (if any) for decontamination, cleaning, maintenance, and repair of protective clothing.
- Emergency procedures and self-rescue in the event of protective clothing/ equipment failure.
- The buddy system.

## **6.7 PPE DONNING AND DOFFING PROCEDURES**

### **Donning Procedures**

- Inspect clothing and respiratory equipment before donning.
- Adjust hard hat or headpiece if worn, to fit user's head.
- If wearing protective clothing - Standing or sitting, step into the legs of the suit; ensure proper placement of the feet within the suit; then gather the suit around the waist.
- Put on safety boots now.
- If using a respirator - Perform negative and positive respirator facepiece seal test procedures.
- To conduct a negative-pressure test, close the inlet part with the palm of the hand or squeeze the breathing tube so it does not pass air, and gently inhale for about 10 seconds. Any inward rushing of air indicates a poor fit. Note that a leaking facepiece may be drawn tightly to the face to form a good seal, giving a false indication of adequate fit.
- To conduct a positive-pressure test, gently exhale while covering the exhalation valve to ensure that a positive pressure can be built up. Failure to build a positive pressure indicates a poor fit.
- Depending on type of suit:
- Put on inner gloves.
- Additional overgloves, worn over attached suit gloves, may be donned later.
- Put on hard hat.
- Secure the suit by closing all fasteners.
- Ensure that the wearer is comfortable and that the equipment is functioning properly.

### **Doffing Procedures**

- Remove any extraneous or disposable clothing, boot covers, outer gloves, and tape.
- Remove safety shoes or boots.
- Remove arms, one at a time, from suit.
- Leave inner gloves on, if any.

- Sitting, if possible, remove both legs from the suit.
- After suit is removed, remove internal gloves by rolling them off the hand, inside out.

## **6.8 PPE INSPECTION PROCEDURES PRIOR TO, DURING, AND AFTER USE**

An effective chemical protective clothing inspection program should feature five different inspections:

- Inspection and operational testing of equipment received as new from the factory or distributor.
- Inspection of equipment as it is selected for a particular chemical operation.
- Inspection of equipment after use or training and prior to maintenance.
- Periodic inspection of stored equipment.
- Periodic inspection when a question arises concerning the appropriateness of selected equipment, or when problems with similar equipment are discovered.

Each inspection will cover different areas with varying degrees of depth. Those personnel responsible for clothing inspection should follow manufacturer directions.

### ***Clothing***

Before use: Determine that the clothing material is correct for the specified task at hand. Visually inspect for: Imperfect seams; non-uniform coatings; tears; and malfunctioning closures. Hold up to light and check for pinholes; flex product and observe for cracks. Check for other signs of shelf deterioration.

If the product has been used previously, inspect inside and out for signs of chemical attack: discoloration, swelling and stiffness

During the work task, periodically inspect for: Evidence of chemical attack such as discoloration, swelling, stiffening and softening. Keep in mind, however, that chemical permeation can occur without any visible effects. Check for closure failure, tears, punctures and seam discontinuities.

**Gloves** - Before use: Pressurize glove to check for pinholes. Either blow into glove, then roll gauntlet towards fingers or inflate glove and hold under water. In either case, no air should escape.

**Safety Glasses** - Check for proper fit, cracks, cleanliness and visibility.

**Safety Shoes/Boots** – Check for cracks, tears, holes, tread wear, and proper lacing.

**Respirators** – Check for proper fit; conduct positive and negative fit checks. Check for cracks in facepiece; elasticity of straps and sealing surface. Make sure the facepiece is clean.

## **6.9 PPE IN USE MONITORING**

During the work task, periodically inspect for evidence of chemical attack such as discoloration, swelling, stiffening and softening. Keep in mind, however, that chemical permeation can occur without any visible effects. Check for closure failure, tears, punctures and seam discontinuities in protective clothing. If clothing or other PPE is soiled remove the soil and or change the clothing or PPE.

## **6.10 EVALUATION OF THE EFFECTIVENESS OF THE PPE PROGRAM**

The PPE management program is reviewed at least annually. Elements considered in the review include:

- The number of person-hours that personnel wear various forms of chemical protective clothing and other equipment;
- Accident and illness experience;
- Levels of exposure;
- Adequacy of equipment selection;
- Adequacy of the operational guidelines;
- Adequacy of decontamination, cleaning, inspection, maintenance, and storage programs;

- Adequacy and effectiveness of training and fitting programs;
- Coordination with overall safety and health program;
- The degree of fulfillment of program objectives;
- The adequacy of program records;
- Recommendations for program improvement and modification; and
- Program costs.

On the Site, the effectiveness of the PPE program is evaluated by observing the workers for fit of equipment, proper use of equipment, wear and tear on equipment, and whether there is evidence of contamination beneath the PPE upon removal.

## **7.0 MONITORING**

Air monitoring is an integral part of the HASP and is used to help determine the appropriate level of protection for field personnel. The SHSO, or qualified designee, is responsible for all air monitoring at the Site. Air monitoring action levels are presented on the next page. The SHSO will use these action levels when determining the need to upgrade or downgrade the level of PPE.

### **7.1 REAL-TIME MONITORING - VOCs**

Monitoring equipment for work where there is a potential for VOC exposure will include a 10.6 volt photo-ionization detector (RAE Systems MiniRAE 2000 or equivalent). Monitoring should be performed in the breathing zone prior to and during intrusive activities and any other activities where there is a potential for exposure to VOCs. If VOCs are consistently detected above background in the work areas then additional area or personal air monitoring or sampling may be necessary to identify the VOCs contributing to PID readings. Readings may be recorded in the Site field log or on the health and safety form - the Real-Time Monitoring Log.

For any work activity, a sustained (greater than 5 minutes) PID reading in the breathing zone above the levels in the table in Section 7.4 will require vapor suppression or avoidance techniques. If these methods are not feasible or do not reduce the potential exposure below acceptable levels, then employees must upgrade to Level C protection, as necessary.

### **7.2 INSTRUMENT CALIBRATION**

Monitoring equipment will be calibrated and checked for proper operation daily before the start-up of any activities requiring monitoring. Before initiating field activities, background measurements will be obtained with each instrument upwind and away from potential Site influences. Instrument calibrations and background levels will be documented on daily air monitoring logs or in a field log.

### **7.3 USE OF DETECTOR TUBES**

Benzene should be used to check for benzene if sustained or repeated readings above background are detected with the PID in areas where volatile organics are expected. Benzene-specific detector tubes capable of measuring down to at least 0.5 ppm must be used, e.g., Dräger tube Benzene 0.5/c, 81-01841. Detector tubes should also be drawn periodically if readings on the PID remain above background but initial detector tube readings are negative.

### **7.4 VOC AIR MONITORING ACTION LEVELS**

<b>Constituent</b>	<b>Concentration</b>	<b>Location</b>	<b>Response</b>
Total Organics (PID)	Above background to 0.5 ppm	Worker Breathing Zone – Intrusive activities	Continue monitoring until reading drops to background or other action is called for.
Total Organics (PID)	0.5 to 5 ppm	Worker Breathing Zone –Intrusive activities	Use detector tubes to check for benzene.
Benzene (detector tube)	0.5 to 5 ppm	Worker breathing zone – intrusive activities	Upgrade to Level C as above. Cartridges are good for only one day.
Benzene (detector tube)	Above 5 ppm	Worker Breathing Zone – intrusive activities	Control source of vapors. If these cannot be controlled stop work and evacuate the area until vapors dissipate. Monitor from a distance.
Total organic vapors (and benzene below 0.5 ppm.)	5 to 25 ppm	Worker Breathing Zone – intrusive activities	Upgrade to Level C – half or full-face respirator with combination organic vapor and P100 dust cartridges.
Total organic vapors (and benzene below 0.5 ppm.)	Above 25 ppm	Worker Breathing Zone – intrusive activities	If vapors cannot be controlled, stop work and evacuate the area until vapors dissipate. Monitor from a distance.
Total Organics (PID)	Consistently above background.	Worker Breathing Zone – intrusive activities	Arrange for air sampling to identify and quantify the potential VOCs.

### **7.5 REAL-TIME MONITORING - DUST**

Monitoring for dust will be conducted prior to and during excavation, soil stockpiling and other dust generating activities in the areas of concern. A portable aerosol monitor will be used to

obtain real-time measurements of dust concentrations upwind, downwind, and cross wind of the work activities and in areas representative of the worker's breathing zone. A Personal DataRAM, or similar instrument, will be used for dust monitoring. Personnel work zone and perimeter dust monitoring will be performed and recorded at the start of potential dust generating operations such as excavating and loading/unloading of trucks, and stockpiling of soil and other dust generating activities. Upwind, background concentrations as well as work area and downwind perimeter area monitoring will be recorded before the start of work and at least every 2 hours during dust generating activities.

For any work activity, a sustained (greater than 5 minutes) dust level in the breathing zone above the concentrations in the following table will require additional dust suppression techniques or working upwind of the contamination. If these methods are not feasible or do not reduce the potential exposure below acceptable levels, then employees must upgrade to Level C protection.

Dust measurements will be made following the manufacturer's instructions on instrument operation and maintenance. The complete manufacturer's operations manual will be on-site at all times.

## **7.6 AIR MONITORING ACTION LEVELS - DUST**

<b>Constituent</b>	<b>Concentration</b>	<b>Location</b>	<b>Response</b>
Dust	Visible	Work zone	Control source of dust.
Dust	0 to 3 mg/m <sup>3</sup>	Worker's breathing zone	Continue monitoring during work activities.
Dust	Above 3 mg/m <sup>3</sup>	Worker's breathing zone	Control source of dust. If dust cannot be controlled upgrade to Level C protection.
Dust	Above 1 mg/m <sup>3</sup>	Downwind perimeter	Immediately control source of dust. Record actions in field log book.

## **7.7 EXPOSURE DETERMINATION FOR HEXAVALENT CHROMIUM**

Because hexavalent chromium may be present in some Site soils an exposure determination will be performed to determine the workers 8-hour time-weighted average (TWA) to hexavalent chromium. Initial monitoring will be performed on potentially exposed workers to characterize full-shift exposures for each job classification in each work area where hexavalent chromium may be present. If initial monitoring indicates that exposures are below the OSHA action level ( $2.5 \text{ ug/m}^3$ ) then monitoring will be discontinued for those employees. If monitoring indicates that employee exposures are at or above the action level, then periodic monitoring will be performed every six months. If monitoring indicates that employee exposures are above the OSHA PEL ( $5 \text{ ug/m}^3$ ) then periodic monitoring will be performed every three months. Additional monitoring will be performed if any changes in work areas or procedures that may result in new or additional exposures to hexavalent chromium.

Personal monitoring samples will be collected by the OSHA/NIOSH-approved method for hexavalent chromium using personal sampling pumps and filters. Samples will be analyzed at an American Industrial Hygiene Association (AIHA) certified industrial hygiene laboratory.



## **8.0 MATERIAL HANDLING AND DECONTAMINATION**

All waste material, decontamination liquids, and decontamination equipment will be handled in a safe and healthful manner. Decontamination and material handling activities will be carried out within the appropriate work zone.

### **8.1 DECONTAMINATION**

For sampling and monitoring activities decontamination may consist of removing and disposing of soiled gloves and cleaning or disposing of soiled equipment and materials. When construction activities are planned a personnel and equipment decontamination area will be provided by the Construction Contractor where surface contamination and outer protective equipment are removed. This area will be determined upon arrival at the Site and before any intrusive activities begin. The KEY representative should be careful to verify appropriate decontamination depending on the procedures implemented.

#### **8.1.1 Personnel Decontamination**

During regular maintenance, sampling and monitoring personnel decontamination consists of removal and disposal of gloves after use then washing with soap and water.

The general decontamination procedure during construction activities is as follows.

##### Level D Decontamination:

- Equipment drop onto plastic drop cloth.
- Wash and rinse boot covers and gloves if to be reused.
- Remove and dispose of Tyvek® suit in a plastic-lined container or plastic bag.
- Remove boot covers and gloves, dispose in plastic bag or lined containers if not to be reused. Place in "decontaminated PPE" container if to be used again.
- Field-wash hands and face.

Level C Decontamination:

- Equipment drop onto plastic drop cloth.
- Wash and rinse boot covers and outer gloves if to be reused.
- Remove boot covers and other gloves; dispose in plastic bag or lined container if not to be reused. Place in "decontaminated PPE" container if to be used again.
- Remove and dispose of Tyvek® suit in a plastic bag or plastic-lined container.
- Wash and rinse inner gloves.
- Remove respirator and place in bin for later cleaning.
- Remove and dispose inner gloves.
- Field-wash face and hands.

There may be partial field decontamination before traveling from one work location to another. This may consist of removing or cleaning boots and gloves after completing an activity and before moving to the next work station. The SHSO will advise the field crew of any necessary field decontamination procedures.

Respirators, non-disposable protective clothing, and other personal articles must be sanitized before they can be used again unless they are assigned to individuals. The SHSO is responsible for monitoring the effectiveness of decontamination procedures and modifying the procedures as necessary to ensure proper decontamination.

### **8.1.2 Equipment Decontamination**

All equipment used in an exclusion zone must be decontaminated before it leaves the Site or is taken into a clean area. Small tools and equipment used in the EZ that become contaminated may be taken to the decontamination area taking care to isolate the tools/equipment from clean materials and equipment. Equipment may be decontaminated by steam cleaning, washing with detergent and water then rinsing, or other appropriate decontamination methods as detailed in the Work Plan for the Site. Verification that equipment/vehicles leaving the Site have been adequately decontaminated is the responsibility of the SHSO.

## **9.0 EMERGENCY PROCEDURES**

Emergency telephone numbers, directions to the nearest hospital, and a route map to the hospital are presented in **Appendix C**.

### **9.1 SITE TOPOGRAPHY AND LAYOUT**

The Sites are located on relatively flat terrain; however a lagoon, marshland, standing water, thick brush, and ditches are present on some areas of the Sites.

### **9.2 OVERVIEW**

Pre-emergency planning consists of the preparation of this emergency response plan, posting of the emergency contact list and hospital route map, assigning emergency functions to on-Site personnel, training of personnel as necessary, and ensuring that emergency procedures and equipment are in place.

The KEY supervisor/SHSO is designated as the Site Emergency Coordinator for KEY's activities and is responsible for field implementation this emergency response plan and has full authority for KEY personnel and KEY subcontractors in the event of an emergency. If outside agencies respond to an emergency the Site Emergency Coordinator will pass the responsibility and authority for emergency response to the Incident Commander for the outside agency as appropriate. The Site Emergency Coordinator will assist outside emergency response agencies as much as possible to control and resolve the emergency. In general, on-site personnel would immediately evacuate the area to the designated safe place of refuge. Communications consist of verbal and hand signals on-site and use of a portable telephone for off-site communication.

The Site Emergency Coordinator, or if the Site Emergency Coordinator is unavailable, the designated alternate on Site, will contact emergency personnel. In the event of severe injury to KEY personnel or subcontractors, KEY may start first aid then contact outside personnel for assistance.

PPE and emergency equipment will be available on-Site for response to minor emergencies. PPE includes gloves, protective clothing, protective booties, and safety glasses.

Safe distances and places of refuge will be upwind of the site activities and will be determined at the time of the emergency based on a combination of site-specific and incident-specific factors. Evacuation routes and places of refuge will be determined before the start of work at the Site and the locations made known to all personnel who enter the Site. The SHSO will maintain security around the immediate Site work zones. Because of the limited number of personnel expected to be working on the Site, the SHSO will know who is on Site and can control entry of personnel into hazardous areas in an emergency.

There are several potential causes of emergencies at hazardous waste sites. Worker-related emergencies may include:

- Minor accidents like slips, trips, and falls.
- Chemical exposure.
- Medical problems such as heat stress, heat stroke and aggravation of pre-existing conditions.
- Failure of personal protective equipment (tearing or permeation of protective clothing).
- Physical injury, e.g., from flying objects, loose clothing entangled in machinery, serious falls.
- Electrocution.

Waste-related emergencies may include:

- Fire.
- Explosion.
- Leaks.
- Release of toxic vapors.
- Incompatible reactions.
- Collapse of containers.

All personnel, especially the supervisors and SHSO, must be constantly alert for indicators of potentially hazardous situations and for symptoms in themselves and others that warn of

hazardous conditions and exposures. Before daily assignments the tasks to be performed, time constraints, potential hazards and emergency procedures are reviewed.

<b>Hazard/Recognition</b>	<b>Emergency Action</b>
Fire/explosion – flames/smoke/heat	If small fire use fire extinguisher to put out. If fire spreads beyond control of employees, call the local fire department at 911.
Minor accidents and physical injury	First-aid trained person to examine victim and treat as needed. If more than first-aid is required summon ambulance or transport or hospital.
Chemical exposure (dust, PAHs)	Wash skin, flush eyes. Put sun lotion on affected area and cover skin. See a physician if severe reaction. See first aid procedures below.
PPE in poor condition or missing.	Stop work and ensure that employees wear proper PPE.

Emergency alerting on-site consists of the use of hand signals and/or radio/cell phone communication. Cell phones will be used for off-site communication. Workers notify the Site Supervisor or SHSO of any emergency. The Site Supervisor or SHSO decides the appropriate action and implements emergency procedures.

Pre-emergency planning consists of the preparation of this emergency response plan, keeping the emergency contact list and hospital route map in the Site vehicle and ensuring that a first aid kit is available.

The sampling personnel are responsible for their own safety and for contacting emergency services as necessary. A cell phone will be used for off-site communication.

### **9.3 EMERGENCY MEDICAL TREATMENT AND FIRST AID**

In the event of a safety or health emergency at the Site, appropriate emergency measures will immediately be taken to assist those who have been injured or exposed and to protect others from hazards. The project field personnel will take the injured party and transport (if possible) to the

nearest hospital for treatment, after determining whether personnel decontamination can be performed on the injured party.

If the injury to a worker is chemical in nature (e.g., overexposure), the following first-aid procedures will be instituted:

- Eye Exposure - If a solid or liquid gets into the eyes, wash the eyes immediately at the emergency eyewash station using large amounts of water and lifting the lower and upper lids occasionally to help flush the eye. Do not let the victim rub eyes or keep eyes tightly closed. Flush for at least 15 minutes. Obtain medical attention immediately.
- Skin Exposure - Promptly wash the area using mild soap and flooding amounts of water for at least 15 minutes while removing contaminated clothing and shoes. Consult a physician for reddened or blistered skin.
- Swallowing - Do not induce vomiting! Never give anything by mouth to an unconscious person. Call poison control center: 1-800-222-1222.
- Breathing - If a person has difficulty breathing, move the exposed person to fresh air at once. Do not use mouth-to-mouth respiration. If breathing has ceased apply artificial respiration using oxygen and a suitable mechanical device such as a bag and mask. Keep the affected person warm and at rest. Obtain medical attention as soon as possible.

#### **9.4 EMERGENCY EVALUATION, INVESTIGATION, AND DOCUMENTATION**

The KEY Project Manager and/or KEY Health & Safety Manager will evaluate the available information about the incident and KEY's emergency response about what happened, any injuries or casualties, further accident potential, and what can be done to remedy the emergency. The type of response will be based on the available information about the emergency incident.

The emergency incident will be investigated and all findings put in writing as soon as conditions return to normal. Ensure that documentation is as complete as possible by including a chronological history of the incident, facts about the incident and when they became available, titles and names of personnel, actions taken, samples and results, possible exposures, and history of all injuries or illness during or as a result of the emergency. After the situation has returned to

normal, all aspects of the emergency incident and the response will be reviewed to assess procedures used, how to improve response, and how to prevent further emergencies.

## **9.5 SPILL CONTAINMENT**

Soils or sediments that spill will be picked up immediately and containerized as appropriate and transported on-site to the stockpile. Sorbent material, shovels and drums are available on-site to handle spills of materials.

## **10.0 TRAINING**

### **10.1 GENERAL**

All employees or other personnel entering the Site Exclusion Zone(s) or Decontamination Zone that are also involved in operations which could involve exposure to hazardous waste will receive training in compliance with OSHA 29 CFR 1910.120.

The training requirements are intended to provide employees with the knowledge and skills necessary to perform hazardous waste Site operations while minimizing the potential for injury. Initial training consists of a minimum of 40 hours of off-Site classroom and practical exercise training and 3 days of actual field experience. Training must be updated annually with 8 hours of off-Site training. Supervising personnel will complete an 8-hour training session for supervisors. Training will be certified by record and/or certificate.

Initial 40-hour off-site training for hazardous waste site workers consists of classroom coursework and practical exercises that include:

- Safety, health and other hazards present at hazardous waste sites;
- Selection and use of personal protective equipment;
- Work practices to minimize risks from site hazards;
- Safe use of engineering controls and equipment on sites;
- Medical surveillance requirements, including recognition of symptoms and signs which might indicate overexposure to hazards;
- Site control measures;
- Decontamination procedures; and,
- Emergency response and contingency planning.

In addition to the 40-hour training, site workers perform actual field activities for at least 3 days under the direct supervision of a trained, experienced supervisor.

Supervisors who are responsible for directing others receive the same training as general site workers plus an additional 8 hours of training on topics such as the overall corporate health and



safety program and employee training program, management of site zones, PPE, spill containment, monitoring procedures and techniques, and supervisory skills.

Annual 8 hour refresher training is required for all field personnel. This training consists of a review of the elements of the 40-hour course, critique of the past year's incidents, and other relevant topics. Information and training on new technologies or equipment for the improved protection of employees is also presented.

All construction employees are required to have the 40-hour initial training. There are no site-specific task limitations on this project that qualify on-site construction personnel for the 24-hour minimum initial training. Workers on site for a specific limited task, such as land surveying, and who are unlikely to be exposed over permissible exposure limits and published exposure limits must have a minimum 24 hours of off-site instruction and a minimum one day actual field experience under the direct supervision of a trained, experienced supervisor.

Personnel responding to Site emergencies have the training and experience to recognize, evaluate, and respond to expected emergency situations. Training includes first aid/CPR courses and the 8-hour supervisor course.

## **10.2 SITE-SPECIFIC TRAINING**

Site-specific training will consist of a health and safety briefing on the following information before the personnel collecting samples travels to the Site:

- Names of individuals responsible for Site health and safety and methods of communicating safety and health concerns;
- Site-specific health and safety hazards;
- Use of PPE;
- Work practices by which employees can minimize risk;
- Safe use of equipment on-Site;
- Recognition of symptoms and signs of exposure to hazardous materials;
- Site control measures;

- Decontamination procedures; and,
- Emergency response procedures.

The Health and Safety Manager or designee will give the health and safety briefing prior to initiation of field activities. This briefing will be of sufficient duration to address all of the material covered in this HASP. All personnel that will be participating in field activities will have had the opportunity to read this HASP prior to this initial meeting so that any questions they have can be addressed at the initial meeting.

### **10.3 SAFETY MEETINGS**

Prior to commencing field activities each day, a short briefing will be conducted by the Site Supervisor to address the day's activities. The daily briefing will provide the opportunity for the SHSO to address any special health and safety issues and to notify individuals of any deficient areas that need to be corrected or operational changes made that affect field work. The briefing will emphasize the specific concerns associated with the day's planned field activities. Daily weather reports will be reviewed to determine work/rest regimens.

## **TABLES**

**TABLE 1**  
**Exposure Limits and Other Properties of Principal Constituents of Interest**  
**Standard Chlorine Chemical Company Site and Diamond Site**  
**Kearny, NJ**

<b>Chemical Compound</b>	<b>Exposure Limits <sup>[b]</sup></b>	<b>STEL <sup>[c]</sup></b>	<b>IDLH <sup>[d]</sup></b>	<b>Vapor Pressure <sup>[e]</sup></b>	<b>Ionization Potential <sup>[f]</sup></b>
Coal Tar Pitch Volatiles (PAHs) <sup>[a]</sup>	0.2 mg/m <sup>3</sup>	NE	80 mg/m <sup>3</sup>	Varies	Varies
Naphthalene	10 ppm	15 ppm	250 ppm	0.08 mm	8.12 eV
Benzene	0.5 ppm	5 ppm	500 ppm	75 mm	9.24 eV
Ethylbenzene	100 ppm	125 ppm	800 ppm	7 mm	8.76 eV
Toluene	50 ppm	NE	500 ppm	21 mm	8.82 eV
Xylene	100 ppm	150 ppm	900 ppm	9 mm	8.56 eV
Chlorobenzene	10 ppm	NE	1,000 ppm	9 mm	9.07 eV
1,2-Dichlorobenzene	25 ppm	50 ppm	200 ppm	1 mm	9.06 eV
1,4-Dichlorobenzene	10 ppm	---	150 ppm	1.3 mm	8.98
1,2,4-Trichlorobenzene	---	5 ppm (c)	100 ppm	19 mm	11.00 eV
Chromium, as Cr VI	0.05 mg/m <sup>3</sup>	0.025 mg/m <sup>3</sup>	15 mg/m <sup>3</sup>	NA	NA

<b>Chemical Compound</b>	<b>Carcinogen <sup>[g]</sup></b>	<b>Skin Exposure <sup>[h]</sup></b>	<b>LEL/UEL <sup>[i]</sup></b>	<b>Odor Threshold <sup>[j]</sup></b>	<b>3M/NIOSH Respirator Selection <sup>[k]</sup></b>
Coal Tar Pitch Volatiles (PAHs)	YES	YES	---	---	R95 or P95
Naphthalene	YES	NO	0.9 - 5.9%	0.015 ppm	OV
Benzene	YES	NO	1.2 - 7.8%	8.65 ppm	OV
Ethylbenzene	NO	NO	0.8 - 6.7%	2.3 ppm	OV
Toluene	NO	YES	1.1 - 7.1%	0.16 ppm	OV
Xylene	NO	NO	1.0 - 7.0%	0.324 ppm	OV
Chlorobenzene	NO	NO	1.3-9.6%	0.741 ppm	OV
1,2-Dichlorobenzene	NO	NO	2.2-9.2	0.072 ppm	(F)OV
1,4-Dichlorobenzene	YES	NO	2.5-?	0.048 ppm	(F)OV/N95
1,2,4-Trichlorobenzene	YES	NO	2.5-6.6	2.91 ppm	OV
Chromium, as Cr VI	YES	NO	NA	NA	N100

**TABLE 1 (cont.)  
Exposure Limits and Other Properties of Principal Constituents of Interest  
Standard Chlorine Chemical Company Site and Diamond Site  
Kearny, NJ**

**Notes:**

- [a] OSHA has not established individual exposure limits for most PAHs. Coal Tar Pitch Volatiles is a category containing several compounds, most of which are classified as PAHs; so Coal Tar Pitch Volatiles can be used as a surrogate for PAHs.
- [b] Exposure Limit: 8-hour Time Weighted Average (TWA) from the 2006 Threshold Limit Values of the ACGIH, or OSHA Permissible Exposure Limit (PEL), whichever is lower.
- [c] STEL: Short Term Exposure Limit denotes a 15 minute average that may not be exceeded.
- [d] IDLH: Immediately Dangerous to Life or Health - Maximum concentration from which one could escape within 30 minutes without a respirator and without experiencing any irreversible health effects.
- [e] Vapor Pressure: From NIOSH Pocket Guide to Chemical Hazards. Water = 0 mm. Above 1 mm is considered volatile; above 100 mm is considered highly volatile
- [f] Ionization Potential: Expressed in electron volts (eV) from NIOSH Pocket Guide to Chemical Hazards. Used to determine type of detector bulb for the PID.
- [g] Carcinogen: "Yes" indicates compound is a confirmed or suspected human carcinogen by NIOSH, OSHA or ACGIH.
- [h] Skin Exposure: "Yes" indicates potential significant exposure through skin and mucous membranes, either by airborne or, more particularly, by direct contact to ambient vapors.
- [i] LEL/UEL: Lower and upper explosive limits. Percent of material needed in air for ignition when exposed to an ignition source.
- [j] Odor Threshold: Air concentration at which most people can smell the chemical.
- [k] 3M/NIOSH Respirator Selection: Type of respirator recommended by the 3M 2006 Respirator Selection Guide or the NIOSH Pocket Guide to Chemical Hazards. SA = Supplied Air (Level B); OV = Organic Vapor Respirator (Level C); N, R, or P 95, 97, or 100 = Dust and mist respirator (Level C).

**TABLE 2**

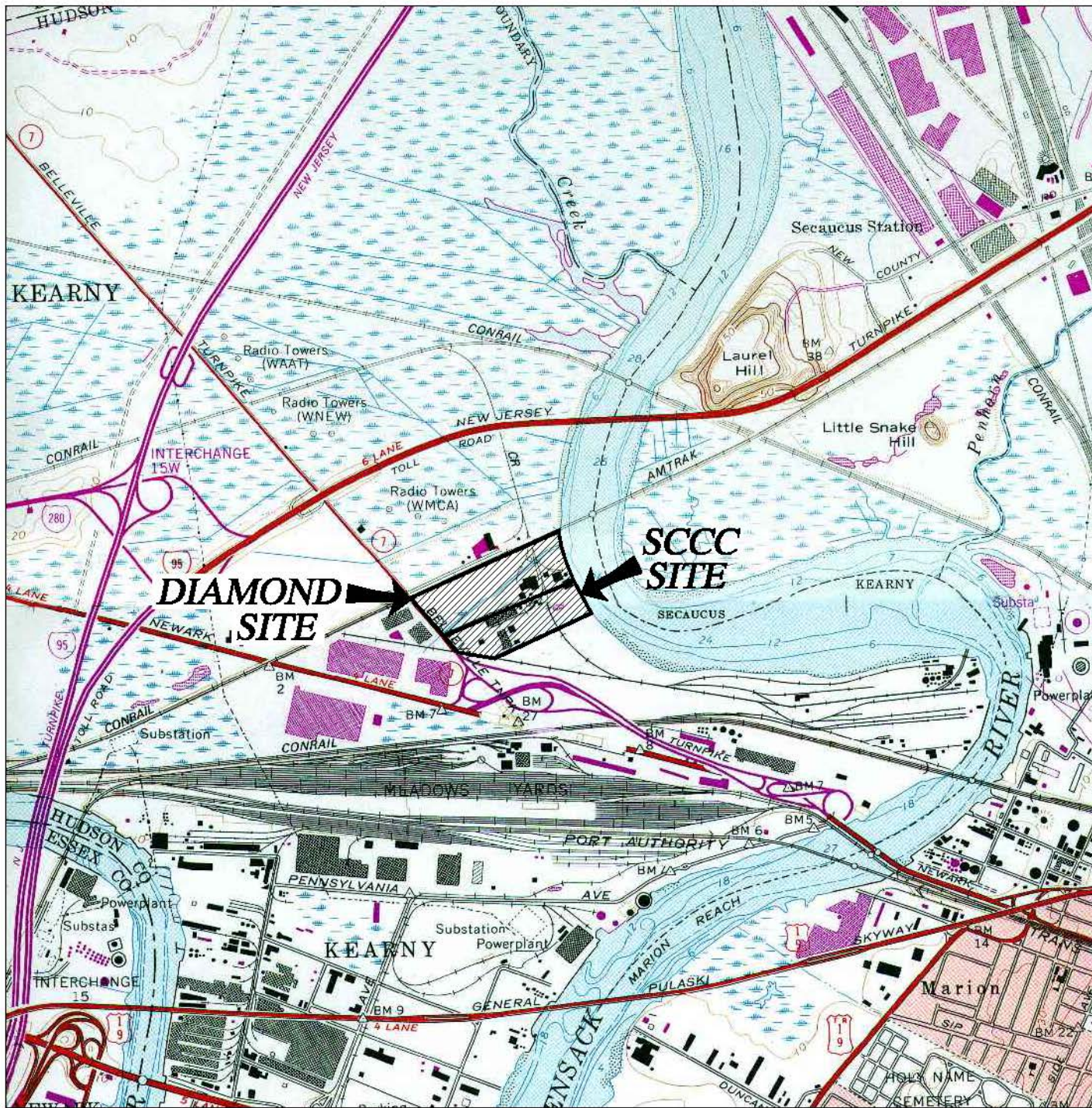
**Task-Specific Hazard Assessment with  
Proposed Initial Levels of Protection and Air Monitoring Requirements  
Standard Chlorine Chemical Company Site and Diamond Site  
Kearny, NJ**

Task	Chemical Hazard Assessment		Estimated Initial Level of Protection*	Real-Time Air Monitoring		
	VOCs	PAHs		VOCs	Dust	Hex. Chrome
Installation of structural barrier – Sheet Pile Wall	LOW	LOW	D	YES	YES	NO
Installation of hydraulic barrier – Slurry Wall	LOW-MED	LOW-MED	D	YES	YES	YES
Construction of Groundwater Recovery and Treatment System	LOW	LOW	D	YES	NO	NO
Installation of DNAPL Recovery System	LOW-MED	LOW-MED	D	YES	NO	NO
Lagoon Dewatering and Backfilling	MED	MED	D	YES	YES	YES
Removal of Near-shore Sediments and Consolidation	LOW-MED	LOW-MED	D	YES	YES	NO
Installation of Surface Cover and Associated Storm Water Controls	LOW	LOW	D	NO	YES	YES

\* Also wear nitrile gloves for activities where there may be hand contact with potentially impacted soil, sediment, groundwater and DNAPL.

## **FIGURES**





# PENINSULA RESTORATION GROUP

DRWN: GLC DATE: 5-09-07  
 CHKD: RJH DATE: 5-09-07  
 APPD: JSZ DATE: 5-09-07  
 SCALE: 1" = 2000'



INTERIM RESPONSE ACTION HEALTH AND SAFETY PLAN  
 SCCG AND DIAMOND SITES  
 KEARNY, NEW JERSEY

SITE LOCATION MAP

PROJECT NO: 07-417  
 FIGURE 1

REFERENCE: USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLES  
 OF JERSEY CITY, AND WEEHAWKEN, NEW JERSEY

ISSUE DATE:

KEY ENVIRONMENTAL, INC.  
 200 THIRD AVENUE  
 CARNEGIE, PA 15106



**APPENDIX A**

**MATERIAL SAFETY DATA SHEETS**

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MSDS Number: **T4875** \* \* \* \* \* *Effective Date: 08/12/02* \* \* \* \* \* *Supersedes: 04/10/00*

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**Material Safety Data Sheet**

From: Mallinckrodt Baker, Inc.  
222 Red School Lane  
Phillipsburg, NJ 08865



24 Hour Emergency Telephone: 908-859-2151  
CHEMTREC: 1-800-424-9300  
National Response in Canada  
CANUTEC: 613-996-6666  
Outside U.S. And Canada  
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

---

# 1,2,4-Trichlorobenzene

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## 1. Product Identification

**Synonyms:** unsym-Trichlorobenzene

**CAS No.:** 120-82-1

**Molecular Weight:** 181.45

**Chemical Formula:** C<sub>6</sub>H<sub>3</sub>Cl<sub>3</sub>

**Product Codes:** 9444

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## 2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
-----	-----	-----	-----
1,2,4-Trichlorobenzene	120-82-1	90 - 100%	Yes

---

## 3. Hazards Identification

### Emergency Overview

-----

**WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER AND REPRODUCTIVE SYSTEM. VAPOR CAUSES RESPIRATORY TRACT IRRITATION AND SEVERE EYE IRRITATION. LIQUID CAUSES SKIN AND EYE IRRITATION.**

**J.T. Baker SAF-T-DATA<sup>(tm)</sup>** Ratings (Provided here for your convenience)

-----

Health Rating: 3 - Severe (Poison)

Flammability Rating: 1 - Slight

Reactivity Rating: 0 - None

Contact Rating: 3 - Severe (Life)

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES

Storage Color Code: Blue (Health)

---

## Potential Health Effects

---

### Inhalation:

Causes irritation to the respiratory tract. Symptoms may include coughing, shortness of breath. Inhalation may lead to drowsiness, uncoordination, narcosis, liver damage, headache, increased heart rate and blood pressure, and tremors.

### Ingestion:

Causes irritation to the gastrointestinal tract. Symptoms may include nausea, vomiting and diarrhea. Other symptoms may parallel those from inhalation. Ingestion of a few ounces could prove fatal.

### Skin Contact:

Causes irritation to skin. Symptoms include redness, itching, and pain. Prolonged contact may cause skin burns. May be absorbed through the skin with possible systemic effects.

### Eye Contact:

Vapors and liquid cause irritation, redness and pain. Vapor concentrations over 5 ppm can cause severe irritation.

### Chronic Exposure:

Prolonged or repeated exposure may affect lungs, liver, kidneys, and skin. May have teratogenic effects.

### Aggravation of Pre-existing Conditions:

Persons with pre-existing disorders of the blood, skin, liver, kidneys or lungs may be at an increased risk from exposure.

---

## 4. First Aid Measures

### Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

### Ingestion:

Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention.

### Skin Contact:

Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.

### Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

---

## 5. Fire Fighting Measures

### Fire:

Flash point: 105C (221F) CC

Flammable limits in air % by volume:

lcl: 2.5; ucl: 6.6

Upper and lower explosive limits were measured at 150C (302F).

**Explosion:**

Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Vapors can flow along surfaces to distant ignition source and flash back.

**Fire Extinguishing Media:**

Water spray, dry chemical, alcohol foam, or carbon dioxide. Use water spray to blanket fire, cool fire exposed containers, and to flush non-ignited spills or vapors away from fire.

**Special Information:**

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

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## 6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

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## 7. Handling and Storage

Keep in a tightly closed container. Store in a cool, dry, ventilated area away from sources of heat or ignition. Protect against physical damage. Store separately from reactive or combustible materials, and out of direct sunlight. Protect from freezing. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

---

## 8. Exposure Controls/Personal Protection

**Airborne Exposure Limits:**

ACGIH STEL:

5 ppm (Ceiling)

**Ventilation System:**

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

**Personal Respirators (NIOSH Approved):**

If the exposure limit is exceeded, a half-face organic vapor respirator may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece organic vapor respirator may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. **WARNING:** Air-purifying

respirators do not protect workers in oxygen-deficient atmospheres.

**Skin Protection:**

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

**Eye Protection:**

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

## 9. Physical and Chemical Properties

**Appearance:**

Clear, colorless liquid.

**Odor:**

Characteristic aromatic odor.

**Solubility:**

Negligible (< 0.1%)

**Specific Gravity:**

1.45 @ 20C/4C

**pH:**

No information found.

**% Volatiles by volume @ 21C (70F):**

100

**Boiling Point:**

213C (415F)

**Melting Point:**

17C (63F)

**Vapor Density (Air=1):**

6.26

**Vapor Pressure (mm Hg):**

1 @ 38.4C (100F)

**Evaporation Rate (BuAc=1):**

No information found.

---

## 10. Stability and Reactivity

**Stability:**

Stable under ordinary conditions of use and storage.

**Hazardous Decomposition Products:**

May produce carbon monoxide, carbon dioxide, hydrogen chloride and phosgene when heated to decomposition.

**Hazardous Polymerization:**

Will not occur.

**Incompatibilities:**

Acids, acid fumes, oxidizers, steam.

**Conditions to Avoid:**

Heat, flames, ignition sources and incompatibles.

---

## 11. Toxicological Information

**Toxicological Data:**

Oral, rat, LD50: 756 mg/kg; Skin, rat, LD50: 6319 mg/kg. Investigated as a tumorigen, mutagen, reproductive effector.

**Reproductive Toxicity:**

May cause teratogenic effects.

**Carcinogenicity:**

EPA / IRIS classification: Group D1 - Not classifiable as a human carcinogen.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
1,2,4-Trichlorobenzene (120-82-1)	No	No	None

## 12. Ecological Information

**Environmental Fate:**

When released into the soil, this material may biodegrade to a moderate extent. When released into the soil, this material is not expected to leach into groundwater. When released into water, this material may biodegrade to a moderate extent. When released into water, this material may evaporate to a moderate extent. When released into water, this material is expected to have a half-life between 10 and 30 days. This material has an experimentally-determined bioconcentration factor (BCF) of greater than 100. This material is expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is not expected to be degraded by photolysis. When released into air, this material is expected to have a half-life between 10 and 30 days.

**Environmental Toxicity:**

This material is expected to be toxic to aquatic life. The LC50/96-hour values for fish are between 1 and 10 mg/l.

## 13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

## 14. Transport Information

**Domestic (Land, D.O.T.)**

-----

**Proper Shipping Name:** TRICHLOROBENZENES, LIQUID

**Hazard Class:** 6.1

**UN/NA:** UN2321

**Packing Group:** III

**Information reported for product/size:** 4L

**International (Water, I.M.O.)**

-----

**Proper Shipping Name:** TRICHLOROBENZENES, LIQUID**Hazard Class:** 6.1**UN/NA:** UN2321**Packing Group:** III**Information reported for product/size:** 4L**International (Air, I.C.A.O.)****Proper Shipping Name:** TRICHLOROBENZENES, LIQUID**Hazard Class:** 6.1**UN/NA:** UN2321**Packing Group:** III**Information reported for product/size:** 4L

## 15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----  
 Ingredient TSCA EC Japan Australia

-----  
 1,2,4-Trichlorobenzene (120-82-1) Yes Yes Yes Yes

-----\Chemical Inventory Status - Part 2\-----

-----  
 Ingredient Korea DSL NDSL Phil.  
 -----

1,2,4-Trichlorobenzene (120-82-1) Yes Yes No Yes

-----\Federal, State & International Regulations - Part 1\-----

-----  
 Ingredient -SARA 302- -SARA 313-----  
 RQ TPQ List Chemical Catg.  
 -----

1,2,4-Trichlorobenzene (120-82-1) No No Yes No

-----\Federal, State & International Regulations - Part 2\-----

-----  
 Ingredient CERCLA -RCRA- -TSCA-  
 -----  
 1,2,4-Trichlorobenzene (120-82-1) 100 261.33 8(d)

Chemical Weapons Convention: No TSCA 12(b): Yes CDTA: No  
 SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No  
 Reactivity: No (Pure / Liquid)

**Australian Hazchem Code:** 2Z**Poison Schedule:** None allocated.**WHMIS:**

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

## 16. Other Information

**NFPA Ratings:** Health: 2 Flammability: 1 Reactivity: 0

**Label Hazard Warning:**

WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER AND REPRODUCTIVE SYSTEM. VAPOR CAUSES RESPIRATORY TRACT IRRITATION AND SEVERE EYE IRRITATION. LIQUID CAUSES SKIN AND EYE IRRITATION.

**Label Precautions:**

Avoid contact with eyes, skin and clothing.

Wash thoroughly after handling.

Avoid breathing vapor or mist.

Keep container closed.

Use only with adequate ventilation.

**Label First Aid:**

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In all cases, get medical attention.

**Product Use:**

Laboratory Reagent.

**Revision Information:**

MSDS Section(s) changed since last revision of document include: 3.

**Disclaimer:**

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\*\*\*\*\*

**Prepared by:** Environmental Health & Safety

Phone Number: (314) 654-1600 (U.S.A.)



MSDS Number: **D2208** \* \* \* \* \* *Effective Date: 11/12/03* \* \* \* \* \* *Supersedes: 02/23/01*

<b>MSDS</b>	<b>Material Safety Data Sheet</b>	24 Hour Emergency Telephone: 908-859-2151 CHEMTREC: 1-800-424-9300
		National Response in Canada CANUTEC: 613-996-6666
		Outside U.S. and Canada Chemtec: 703-527-3887
From: Mallinckrodt Baker, Inc. 222 Red School Lane Phillipsburg, NJ 08865		 <b>Mallinckrodt CHEMICALS</b> 
NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.		
All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.		

# O-DICHLOROBENZENE

## 1. Product Identification

**Synonyms:** 1,2-dichlorobenzene; ortho-Dichlorobenzene; DCB

**CAS No.:** 95-50-1

**Molecular Weight:** 147.00

**Chemical Formula:** C<sub>6</sub>H<sub>4</sub>Cl<sub>2</sub>

**Product Codes:**

J.T. Baker: 9217, 9233

Mallinckrodt: 1830

## 2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
o-Dichlorobenzene	95-50-1	> 99%	Yes
p-Dichlorobenzene	106-46-7	0 - 0.16%	Yes

## 3. Hazards Identification

### Emergency Overview

**DANGER! ASPIRATION MAY CAUSE LUNG DAMAGE. VAPORS CAUSE IRRITATION TO EYES AND RESPIRATORY TRACT. LIQUID CAUSES SKIN IRRITATION AND SEVERE EYE IRRITATION. HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. AFFECTS LIVER, KIDNEYS AND BLOOD. COMBUSTIBLE LIQUID AND VAPOR. POSSIBLE**

**CANCER HAZARD. CONTAINS P-DICHLOROBENZENE WHICH MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends upon duration and level of exposure.**

**J.T. Baker SAF-T-DATA<sup>(tm)</sup>** Ratings (Provided here for your convenience)

-----

Health Rating: 2 - Moderate

Flammability Rating: 2 - Moderate

Reactivity Rating: 0 - None

Contact Rating: 1 - Slight

Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER

Storage Color Code: Red (Flammable)

-----

### **Potential Health Effects**

-----

#### **Inhalation:**

Causes irritation to the respiratory tract. Can cause headache, nausea, swelling around the eyes, runny nose, loss of appetite and weight loss. Higher concentrations may cause drowsiness, central nervous system depression, kidney and liver damage, unconsciousness, and death.

#### **Ingestion:**

Toxic! A liver and kidney poison. May cause systemic poisoning with/symptoms paralleling inhalation. May be an aspiration hazard if swallowed.

#### **Skin Contact:**

Skin contact causes irritations and possibly burns if contact is repeated or prolonged. May be absorbed through the skin.

#### **Eye Contact:**

Vapors cause irritation, redness, and pain. Contact with liquid may cause burning of the eyes and tissue damage.

#### **Chronic Exposure:**

Chronic exposure may damage blood, liver and kidneys. p-Dichlorobenzene is a possible carcinogen. Prolonged or repeated skin exposure may cause dermatitis and blisters. Prolonged or repeated exposure through any route may cause symptoms paralleling acute inhalation.

#### **Aggravation of Pre-existing Conditions:**

Persons with pre-existing skin problems, kidney or liver damage may be more susceptible to the affects of this material.

---

## **4. First Aid Measures**

#### **Inhalation:**

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

#### **Ingestion:**

Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately.

#### **Skin Contact:**

Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.

#### **Eye Contact:**

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids

occasionally. Get medical attention immediately.

---

## 5. Fire Fighting Measures

### **Fire:**

Flash point: 66C (151F) CC

Autoignition temperature: 648C (1198F)

Flammable limits in air % by volume:

lcl: 2.2; ucl: 9.2

Combustible.

### **Explosion:**

Above flash point, vapor-air mixtures are explosive within flammable limits noted above.

### **Fire Extinguishing Media:**

Water spray, dry chemical, alcohol foam, or carbon dioxide. Water spray may be used to keep fire exposed containers cool.

### **Special Information:**

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Combustion by-products include phosgene and hydrogen chloride gases.

---

## 6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker SOLUSORB® solvent adsorbent is recommended for spills of this product.

---

## 7. Handling and Storage

Keep in a tightly closed container. Store in a cool, dry, ventilated area away from sources of heat or ignition. Protect against physical damage. Store separately from reactive or combustible materials, and out of direct sunlight. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

---

## 8. Exposure Controls/Personal Protection

### **Airborne Exposure Limits:**

-OSHA Permissible Exposure Limit (PEL):

50 ppm Ceiling limit

for p-Dichlorobenzene: 75 ppm (TWA)

-ACGIH Threshold Limit Value (TLV):

25 ppm (TWA) 50 ppm (STEL), listed as A4, Not classifiable as a human carcinogen  
for p-Dichlorobenzene: 10 ppm (TWA), listed as A3, animal carcinogen.

**Ventilation System:**

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

**Personal Respirators (NIOSH Approved):**

If the exposure limit is exceeded, a full facepiece respirator with organic vapor cartridge and dust/mist filter may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. **WARNING:** Air purifying respirators do not protect workers in oxygen-deficient atmospheres. This compound possibly exists in both particulate and vapor phase. A dust/mist prefilter should be used for the particulate.

**Skin Protection:**

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

**Eye Protection:**

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

## 9. Physical and Chemical Properties

**Appearance:**

Colorless to yellowish liquid.

**Odor:**

Pleasant odor.

**Solubility:**

Practically insoluble in water.

**Specific Gravity:**

1.30 @ 20C/4C

**pH:**

No information found.

**% Volatiles by volume @ 21C (70F):**

No information found.

**Boiling Point:**

180C (356F)

**Melting Point:**

-17.6C (0F)

**Vapor Density (Air=1):**

5.1

**Vapor Pressure (mm Hg):**

1.2 @ 20C (68F)

**Evaporation Rate (BuAc=1):**

< 1

---

## 10. Stability and Reactivity

**Stability:**

Stable under ordinary conditions of use and storage.

**Hazardous Decomposition Products:**

May emit oxides of carbon and hydrogen chloride gas when heated to decomposition. May produce carbon monoxide, carbon dioxide, hydrogen chloride and phosgene when heated to decomposition.

**Hazardous Polymerization:**

Will not occur.

**Incompatibilities:**

Strong oxidizers, aluminum or aluminum alloys.

**Conditions to Avoid:**

Heat, flames, ignition sources and incompatibles.

---

## 11. Toxicological Information

Oral rat LD50: 500 mg/kg. Investigated as a tumorigen, mutagen, reproductive effector.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
o-Dichlorobenzene (95-50-1)	No	No	3
p-Dichlorobenzene (106-46-7)	No	Yes	2B

---

## 12. Ecological Information

**Environmental Fate:**

When released into the soil, this material may biodegrade to a moderate extent. When released into the soil, this material may leach into groundwater. When released into the soil, this material may evaporate to a moderate extent. When released into water, this material may biodegrade to a moderate extent. When released into water, this material may evaporate to a moderate extent. Although this material has a relatively short half-life in water, it can also readily be adsorbed to sediment and persist for decades. When released into water, this material is expected to have a half-life between 10 and 30 days. This material has an experimentally-determined bioconcentration factor (BCF) of greater than 100. This material may bioaccumulate to some extent. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material may be removed from the atmosphere to a moderate extent by wet deposition. When released into air, this material is expected to have a half-life between 10 and 30 days.

**Environmental Toxicity:**

No information found.

---

## 13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

---

## 14. Transport Information

### Domestic (Land, D.O.T.)

-----  
**Proper Shipping Name:** O-DICHLOROBENZENE

**Hazard Class:** 6.1

**UN/NA:** UN1591

**Packing Group:** III

**Information reported for product/size:** 4L

### International (Water, I.M.O.)

-----  
**Proper Shipping Name:** ORTHO-DICHLOROBENZENE

**Hazard Class:** 6.1

**UN/NA:** UN1591

**Packing Group:** III

**Information reported for product/size:** 4L

### International (Air, I.C.A.O.)

-----  
**Proper Shipping Name:** ORTHO-DICHLOROBENZENE

**Hazard Class:** 6.1

**UN/NA:** UN1591

**Packing Group:** III

**Information reported for product/size:** 4L

## 15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----				
Ingredient	TSCA	EC	Japan	Australia
-----				
o-Dichlorobenzene (95-50-1)	Yes	Yes	Yes	Yes
p-Dichlorobenzene (106-46-7)	Yes	Yes	Yes	Yes

-----\Chemical Inventory Status - Part 2\-----				
Ingredient	Korea	--Canada--		
		DSL	NDSL	Phil.
-----				
o-Dichlorobenzene (95-50-1)	Yes	Yes	No	Yes
p-Dichlorobenzene (106-46-7)	Yes	Yes	No	Yes

-----\Federal, State & International Regulations - Part 1\-----				
Ingredient	-SARA 302-		-----SARA 313-----	
	RQ	TPQ	List	Chemical Catg.
-----				
o-Dichlorobenzene (95-50-1)	No	No	Yes	No
p-Dichlorobenzene (106-46-7)	No	No	Yes	No

-----\Federal, State & International Regulations - Part 2\-----			
Ingredient	CERCLA	-RCRA-	-TSCA-
		261.33	8(d)
-----			
o-Dichlorobenzene (95-50-1)	100	U070	No
p-Dichlorobenzene (106-46-7)	100	U072	No

Chemical Weapons Convention: No      TSCA 12(b): Yes      CDTA: Yes  
SARA 311/312: Acute: Yes      Chronic: Yes      Fire: Yes      Pressure: No

Reactivity: No

(Mixture / Liquid)

**WARNING:**

THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

**Australian Hazchem Code:** 2Z**Poison Schedule:** None allocated.**WHMIS:**

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

## 16. Other Information

**NFPA Ratings:** Health: 2 Flammability: 2 Reactivity: 0**Label Hazard Warning:**

DANGER! ASPIRATION MAY CAUSE LUNG DAMAGE. VAPORS CAUSE IRRITATION TO EYES AND RESPIRATORY TRACT. LIQUID CAUSES SKIN IRRITATION AND SEVERE EYE IRRITATION. HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. AFFECTS LIVER, KIDNEYS AND BLOOD. COMBUSTIBLE LIQUID AND VAPOR. POSSIBLE CANCER HAZARD. CONTAINS P-DICHLOROBENZENE WHICH MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends upon duration and level of exposure.

**Label Precautions:**

Do not breathe vapor.

Do not get in eyes, on skin, or on clothing.

Keep container closed.

Use only with adequate ventilation.

Wash thoroughly after handling.

Keep away from heat and flame.

**Label First Aid:**

Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Get medical attention. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

**Product Use:**

Laboratory Reagent.

**Revision Information:**

No Changes.

**Disclaimer:**

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**Prepared by:** Environmental Health & Safety  
Phone Number: (314) 654-1600 (U.S.A.)



# Material Safety Data Sheet

1,3-Dichlorobenzene, 98%

ACC# 62847

## Section 1 - Chemical Product and Company Identification

**MSDS Name:** 1,3-Dichlorobenzene, 98%

**Catalog Numbers:** AC151180000, AC151180010, AC151180050, AC151180250, AC151181000, AC151182500  
AC151182500, AC151185000

**Synonyms:** m-Dichlorobenzene; Benzene, 1,3-dichloro-; m-Phenylenedichloride

**Company Identification:**

Acros Organics N.V.

One Reagent Lane

Fair Lawn, NJ 07410

**For information in North America, call:** 800-ACROS-01

**For emergencies in the US, call CHEMTREC:** 800-424-9300

## Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
541-73-1	1,3-Dichlorobenzene	98	208-792-1

**Hazard Symbols:** XN N

**Risk Phrases:** 22

## Section 3 - Hazards Identification

### EMERGENCY OVERVIEW

Appearance: Clear - Colorless Liquid. Flash Point: 67 deg C. **Combustible liquid and vapor. Warning!**

Causes eye and skin irritation. Causes digestive and respiratory tract irritation. Harmful if swallowed. May be absorbed through intact skin.

**Target Organs:** Kidneys, liver.

### Potential Health Effects

**Eye:** Causes eye irritation.

**Skin:** Causes skin irritation. May be absorbed through the skin.

**Ingestion:** Harmful if swallowed. Causes gastrointestinal irritation with nausea, vomiting and diarrhea.

**Inhalation:** Causes respiratory tract irritation.

**Chronic:** Chronic exposure may cause liver damage. Chronic exposure may cause kidney damage.

## Section 4 - First Aid Measures

**Eyes:** Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.

**Skin:** Get medical aid immediately. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

**Ingestion:** Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

**Inhalation:** Remove from exposure and move to fresh air immediately. If breathing is difficult, give oxygen. Get medical aid. If breathing has ceased apply artificial respiration using oxygen and a suitable mechanical device such as a bag and a mask.

**Notes to Physician:** Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

**General Information:** As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Water runoff can cause environmental damage. Dike and collect water used to fight fire. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Use water spray to keep fire-exposed containers cool. Combustible liquid. Vapors may be heavier than air. They can spread along the ground and collect in low or confined areas. Containers may explode when heated.

**Extinguishing Media:** Do NOT get water inside containers. For small fires, use dry chemical, carbon dioxide, or water spray. For large fires, use dry chemical, carbon dioxide, alcohol-resistant foam, or water spray. Cool containers with flooding quantities of water until well after fire is out.

**Flash Point:** 67 deg C ( 152.60 deg F)

**Autoignition Temperature:** 640 deg C ( 1,184.00 deg F)

**Explosion Limits, Lower:**Not available.

**Upper:** Not available.

**NFPA Rating:** (estimated) Health: 2; Flammability: 2; Instability: 0

## Section 6 - Accidental Release Measures

**General Information:** Use proper personal protective equipment as indicated in Section 8.

**Spills/Leaks:** Avoid runoff into storm sewers and ditches which lead to waterways. Remove all sources of ignition. Provide ventilation. Cover with dry earth, dry sand, or other non-combustible material followed with plastic sheet to minimize spreading and contact with water. Stop leak only if you can do so without risk.

## Section 7 - Handling and Storage

**Handling:** Wash thoroughly after handling. Use only in a well-ventilated area. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep container tightly closed. Keep away from heat, sparks and flame. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames.

**Storage:** Keep away from heat, sparks, and flame. Keep away from sources of ignition. Store in a tightly closed container. Keep from contact with oxidizing materials. Store in a cool, dry, well-ventilated area away from incompatible substances.

## Section 8 - Exposure Controls, Personal Protection

**Engineering Controls:** Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.

### Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
1,3-Dichlorobenzene	none listed	none listed	none listed

**OSHA Vacated PELs:** 1,3-Dichlorobenzene: No OSHA Vacated PELs are listed for this chemical.

### Personal Protective Equipment

**Eyes:** Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

**Skin:** Wear appropriate protective gloves to prevent skin exposure.

**Clothing:** Wear appropriate protective clothing to prevent skin exposure.

**Respirators:** A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2

requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

## Section 9 - Physical and Chemical Properties

**Physical State:** Liquid

**Appearance:** Clear - Colorless Liquid

**Odor:** None reported.

**pH:** Not available.

**Vapor Pressure:** 1.8 hPa @ 20 C

**Vapor Density:** 5.07

**Evaporation Rate:** Not available.

**Viscosity:** 1.045 cP 23 deg C

**Boiling Point:** 172.0 - 173.0 deg C @ 760.00m

**Freezing/Melting Point:** -24 deg C

**Decomposition Temperature:** > 300 deg C

**Solubility:** Insoluble.

**Specific Gravity/Density:** 1.2880g/cm<sup>3</sup>

**Molecular Formula:** C<sub>6</sub>H<sub>4</sub>Cl<sub>2</sub>

**Molecular Weight:** 147.00

## Section 10 - Stability and Reactivity

**Chemical Stability:** Stable under normal temperatures and pressures.

**Conditions to Avoid:** Incompatible materials, ignition sources, excess heat.

**Incompatibilities with Other Materials:** Strong oxidizing agents, aluminum.

**Hazardous Decomposition Products:** Hydrogen chloride, carbon monoxide, carbon dioxide.

**Hazardous Polymerization:** Has not been reported.

## Section 11 - Toxicological Information

**RTECS#:**

**CAS#** 541-73-1: CZ4499000

**LD50/LC50:**

Not available.

**Carcinogenicity:**

CAS# 541-73-1:

**IARC:** IARC Group 3 - not classifiable

**Epidemiology:** No information.

**Teratogenicity:** No data available.

**Reproductive Effects:** No information.

**Neurotoxicity:** No information.

**Mutagenicity:** Gene conversion and mitotic recombination: *Saccharomyces cerevisiae* = 5ppm.; Micronucleus test-Intraperitoneal, mouse = 175 mg/kg/24H.

**Other Studies:** No data available.

## Section 12 - Ecological Information

**Ecotoxicity:** Fish: Fathead Minnow: 12.7 mg/L; 96 Hr; Static Bioassay Experimental BCF Values of 89-740 reported, and 1,3-Dichlorobenzene was detected in trout in Lake Ontario. Koc values of 12600-31600 calculated from sediment/water monitoring data in Great Lakes Area. An experimental Koc value of 293 was calculated in a

silt loam soil containing 1.9% organic matter. 1,3-Dichlorobenzene can be moderately to highly absorbed to soil. Leaching can occur.

**Environmental:** No information available.

**Physical:** No information available.

**Other:** No information available.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

**RCRA P-Series:** None listed.

**RCRA U-Series:** CAS# 541-73-1: waste number U071.

## Section 14 - Transport Information

	US DOT	IATA	RID/ADR	IMO	Canada TDG
<b>Shipping Name:</b>	TOXIC LIQUIDS, ORGANIC, N.O.S.				No information available.
<b>Hazard Class:</b>	6.1				
<b>UN Number:</b>	UN2810				
<b>Packing Group:</b>	III				

## Section 15 - Regulatory Information

### US FEDERAL

#### TSCA

CAS# 541-73-1 is listed on the TSCA inventory.

#### Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

#### Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

#### Section 12b

None of the chemicals are listed under TSCA Section 12b.

#### TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

#### SARA

#### CERCLA Hazardous Substances and corresponding RQs

CAS# 541-73-1: 100 lb final RQ; 45.4 kg final RQ

#### SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

#### SARA Codes

CAS # 541-73-1: acute, chronic, flammable.

#### Section 313

This material contains 1,3-Dichlorobenzene (CAS# 541-73-1, 98%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

#### Clean Air Act:

This material does not contain any hazardous air pollutants. This material does not contain any Class 1 Ozone depleters. This material does not contain any Class 2 Ozone depleters.

#### Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA. CAS# 541-73-1 is listed as a Priority Pollutant under the Clean Water Act. CAS# 541-73-1 is listed as a Toxic Pollutant under the

Clean Water Act.

**OSHA:**

None of the chemicals in this product are considered highly hazardous by OSHA.

**STATE**

CAS# 541-73-1 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Massachusetts.

California No Significant Risk Level: None of the chemicals in this product are listed.

## **European/International Regulations**

### **European Labeling in Accordance with EC Directives**

**Hazard Symbols:**

XN N

**Risk Phrases:**

R 22 Harmful if swallowed.

R 51/53 Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

**Safety Phrases:**

S 61 Avoid release to the environment. Refer to special instructions/safety data sheets.

### **WGK (Water Danger/Protection)**

CAS# 541-73-1: 2

### **Canada - DSL/NDSL**

CAS# 541-73-1 is listed on Canada's DSL List.

### **Canada - WHMIS**

This product has a WHMIS classification of B3, D1B, D2A.

### **Canadian Ingredient Disclosure List**

CAS# 541-73-1 is listed on the Canadian Ingredient Disclosure List.

### **Exposure Limits**

## **Section 16 - Additional Information**

**MSDS Creation Date:** 11/03/1998

**Revision #3 Date:** 3/18/2003

*The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.*

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MSDS Number: **D2224** \* \* \* \* \* *Effective Date: 08/10/04* \* \* \* \* \* *Supercedes: 11/02/01*

---

**Material Safety Data Sheet**

From: Mallinckrodt Baker, Inc.  
222 Red School Lane  
Phillipsburg, NJ 08865



24 Hour Emergency Telephone: 908-859-2151  
CHEMTREC: 1-800-424-9300  
National Response in Canada  
CANUTEC: 613-996-6666  
Outside U.S. And Canada  
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

---

# p-DICHLOROBENZENE

---

## 1. Product Identification

**Synonyms:** 1,4-Dichlorobenzene; para-dichlorobenzene; Paracide; PDCB

**CAS No.:** 106-46-7

**Molecular Weight:** 147.01

**Chemical Formula:** C<sub>6</sub>H<sub>4</sub>Cl<sub>2</sub>

**Product Codes:** G970

---

## 2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
p-Dichlorobenzene	106-46-7	100%	Yes

---

## 3. Hazards Identification

### Emergency Overview

**WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. AFFECTS THE RESPIRATORY SYSTEM, LIVER, KIDNEYS, EYES, SKIN AND BLOOD. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. COMBUSTIBLE. POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA.**

**J.T. Baker SAF-T-DATA<sup>(tm)</sup>** Ratings (Provided here for your convenience)

---

Health Rating: 3 - Severe (Cancer Causing)

Flammability Rating: 2 - Moderate

Reactivity Rating: 0 - None

Contact Rating: 2 - Moderate

Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER.

Storage Color Code: Red (Flammable)

---

## Potential Health Effects

---

### Inhalation:

Inhalation of dust or vapors can irritate the nose and throat. May also cause headache, swelling around the eyes and runny nose. Can cause loss of appetite, nausea, vomiting, central nervous system effects, weight loss and liver and kidney damage.

### Ingestion:

Toxic. Swallowing can produce adverse health effects paralleling inhalation.

### Skin Contact:

Causes skin irritation, with a slight burning sensation. Red blotching of the skin due to allergic reactions may occur. May be absorbed through the skin; symptoms may parallel inhalation.

### Eye Contact:

Causes irritation, redness, and pain.

### Chronic Exposure:

Chronic exposure may damage blood, lungs, central nervous system, liver and kidneys. p-Dichlorobenzene is a possible carcinogen.

### Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders or eye problems, or impaired liver, kidney or respiratory function may be more susceptible to the effects of the substance.

---

## 4. First Aid Measures

### Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

### Ingestion:

Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Call a physician.

### Skin Contact:

Wash skin with soap or mild detergent and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Call a physician.

### Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

---

## 5. Fire Fighting Measures

### Fire:

Flash point: 66C (151F) CC

Combustible!

### Explosion:

Above the flash point, explosive vapor-air mixtures may be formed. Contact with strong oxidizers may cause fire.

**Fire Extinguishing Media:**

Water spray, dry chemical, alcohol foam, or carbon dioxide. Water spray may be used to keep fire exposed containers cool, dilute spills to nonflammable mixtures, protect personnel attempting to stop leak and disperse vapors.

**Special Information:**

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

---

## 6. Accidental Release Measures

Remove all sources of ignition. Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Clean up spills in a manner that does not disperse dust into the air. Use non-sparking tools and equipment. Reduce airborne dust and prevent scattering by moistening with water. Pick up spill for recovery or disposal and place in a closed container. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

---

## 7. Handling and Storage

Protect against physical damage. Outside or detached storage is preferred. Inside storage should be in a standard flammable liquids storage room or cabinet. Separate from oxidizing materials. Storage and use areas should be No Smoking areas. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

---

## 8. Exposure Controls/Personal Protection

**Airborne Exposure Limits:**

-OSHA Permissible Exposure Limit (PEL):

75 ppm (TWA)

-ACGIH Threshold Limit Value (TLV):

10 ppm (TWA), listed as A3, animal carcinogen.

**Ventilation System:**

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

**Personal Respirators (NIOSH Approved):**

If the exposure limit is exceeded, and engineering controls are not feasible, a full-face piece respirator with an organic vapor cartridge and particulate filter (NIOSH type N100 filter) may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P particulate filter. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. **WARNING:** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.



**Skin Protection:**

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

**Eye Protection:**

Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

## 9. Physical and Chemical Properties

**Appearance:**

White crystals.

**Odor:**

Moth-ball odor

**Solubility:**

Practically insoluble in water.

**Specific Gravity:**

1.25 @ 20C/4C

**pH:**

No information found.

**% Volatiles by volume @ 21C (70F):**

100

**Boiling Point:**

174C (345F)

**Melting Point:**

53C (127F)

**Vapor Density (Air=1):**

5.08

**Vapor Pressure (mm Hg):**

10 @ 54.8C (131F)

**Evaporation Rate (BuAc=1):**

Not applicable.

---

## 10. Stability and Reactivity

**Stability:**

Stable under ordinary conditions of use and storage.

**Hazardous Decomposition Products:**

May produce carbon monoxide, carbon dioxide, hydrogen chloride and phosgene when heated to decomposition.

**Hazardous Polymerization:**

Will not occur.

**Incompatibilities:**

Oxidizing agents, aluminum and its alloys.

**Conditions to Avoid:**

Heat, flames, ignition sources and incompatibles.

---

## 11. Toxicological Information

Oral rat LD50: 500 mg/kg; skin rabbit LD50: > 2 gm/kg; investigated as a tumorigen, mutagen, reproductive effector.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
-----			
p-Dichlorobenzene (106-46-7)	No	Yes	2B

---

## 12. Ecological Information

### Environmental Fate:

When released into the soil, this material may leach into groundwater. When released into the soil, this material may evaporate to a moderate extent. When released into the soil, this material may biodegrade to a moderate extent. When released into water, this material may evaporate to a moderate extent. When released into water, this material may biodegrade to a moderate extent. This material has an experimentally-determined bioconcentration factor (BCF) of greater than 100. This material may bioaccumulate to some extent. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life of greater than 30 days. When released into the air, this material may be removed from the atmosphere to a moderate extent by wet deposition.

### Environmental Toxicity:

The LC50/96-hour values for fish are between 1 and 10 mg/l. The LC50/96-hour values for fish are between 10 and 100 mg/l. This material may be toxic to aquatic life.

---

## 13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

---

## 14. Transport Information

### Domestic (Land, D.O.T.)

-----  
**Proper Shipping Name:** ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.  
(PARA-DICHLOROBENZENE)

**Hazard Class:** 9

**UN/NA:** UN3077

**Packing Group:** III

**Information reported for product/size:** 5KG

### International (Water, I.M.O.)

-----  
**Proper Shipping Name:** ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.  
(PARA-DICHLOROBENZENE)

**Hazard Class: 9****UN/NA: UN3077****Packing Group: III****Information reported for product/size: 5KG****International (Air, I.C.A.O.)****Proper Shipping Name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.  
(PARA-DICHLOROBENZENE)****Hazard Class: 9****UN/NA: UN3077****Packing Group: Information reported for product/size: 5KG**

## 15. Regulatory Information

```

-----\Chemical Inventory Status - Part 1\-----
Ingredient                                     TSCA   EC     Japan  Australia
-----
p-Dichlorobenzene (106-46-7)                 Yes    Yes    Yes     Yes

```

```

-----\Chemical Inventory Status - Part 2\-----
Ingredient                                     Korea  DSL    NDSL   Phil.
-----
p-Dichlorobenzene (106-46-7)                 Yes    Yes    No      Yes

```

```

-----\Federal, State & International Regulations - Part 1\-----
Ingredient                                     -SARA 302-  -----SARA 313-----
                                     RQ    TPQ      List  Chemical Catg.
-----
p-Dichlorobenzene (106-46-7)                 No     No       Yes     No

```

```

-----\Federal, State & International Regulations - Part 2\-----
Ingredient                                     CERCLA  -RCRA-  -TSCA-
                                     261.33  8(d)
-----
p-Dichlorobenzene (106-46-7)                 100     U072    No

```

Chemical Weapons Convention: No      TSCA 12(b): No      CDTA: Yes  
 SARA 311/312: Acute: Yes      Chronic: Yes      Fire: Yes      Pressure: No  
 Reactivity: No      (Pure / Solid)

### WARNING:

THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

**Australian Hazchem Code:** None allocated.

**Poison Schedule:** None allocated.

### WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

## 16. Other Information

**NFPA Ratings:** Health: **2** Flammability: **2** Reactivity: **0**

**Label Hazard Warning:**

WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. AFFECTS THE RESPIRATORY SYSTEM, LIVER, KIDNEYS, EYES, SKIN AND BLOOD. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. COMBUSTIBLE. POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA.

**Label Precautions:**

Avoid breathing dust or vapors.  
Use only with adequate ventilation.  
Avoid contact with eyes, skin and clothing.  
Keep container closed.  
Use with adequate ventilation.  
Wash thoroughly after handling.  
Keep away from heat and flame.

**Label First Aid:**

If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician.

**Product Use:**

Laboratory Reagent.

**Revision Information:**

No Changes.

**Disclaimer:**

\*\*\*\*\*

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\*\*\*\*\*

**Prepared by:** Environmental Health & Safety

Phone Number: (314) 654-1600 (U.S.A.)

# Material Safety Data Sheet

## Benzene

ACC# 02610

### Section 1 - Chemical Product and Company Identification

**MSDS Name:** Benzene

**Catalog Numbers:** AC167660000, AC167660010, AC167660025, AC167660250, AC167665000, AC168650025, AC168650250, AC295330000, AC295330010, AC295330025, AC295330250, AC296880000, AC296880010, AC296880025, AC296880250, AC610230010, AC610231000, AC610510190, AC610510500, AC610511150, AC610512000, AC610710000, AC610710190, AC610710500, AC610711150, AC610712000, AC611001000, B243-4, B245-4, B245-500, B245J4, B411-1, B411-4, B412-1, B414-1, BP2601-100, S79920ACS

**Synonyms:** Benzol; Cyclohexatriene; Phenyl hydride.**Company Identification:**

Fisher Scientific  
1 Reagent Lane  
Fair Lawn, NJ 07410

**For information, call:** 201-796-7100**Emergency Number:** 201-796-7100**For CHEMTREC assistance, call:** 800-424-9300**For International CHEMTREC assistance, call:** 703-527-3887

### Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
71-43-2	Benzene	> 99	200-753-7

**Hazard Symbols:** T F**Risk Phrases:** 11 45 48/23/24/25

### Section 3 - Hazards Identification

#### EMERGENCY OVERVIEW

Appearance: clear colorless liquid. Flash Point: -11 deg C. **Danger!** May cause blood abnormalities. Cancer hazard. May cause central nervous system effects. Aspiration hazard if swallowed. Can enter lungs and cause damage. Extremely flammable liquid and vapor. Vapor may cause flash fire. Harmful if swallowed, inhaled, or absorbed through the skin. Causes eye, skin, and respiratory tract irritation.

**Target Organs:** Blood, central nervous system, respiratory system, eyes, bone marrow, immune system, skin.**Potential Health Effects****Eye:** Causes eye irritation.**Skin:** Causes skin irritation. Harmful if absorbed through the skin. Prolonged and/or repeated contact may cause defatting of the skin and dermatitis.**Ingestion:** May cause central nervous system depression, characterized by excitement, followed by headache, dizziness, drowsiness, and nausea. Advanced stages may cause collapse, unconsciousness, coma and possible death due to respiratory failure. May cause effects similar to those for inhalation exposure. Aspiration of material into the lungs may cause chemical pneumonitis, which may be fatal.**Inhalation:** Causes respiratory tract irritation. May cause drowsiness, unconsciousness, and central nervous system depression. Exposure may lead to irreversible bone marrow injury. Exposure may lead to aplastic anemia. Potential symptoms of overexposure by inhalation are dizziness, headache, vomiting, visual disturbances, staggering gait, hilarity, fatigue, and other symptoms of CNS depression.**Chronic:** May cause bone marrow abnormalities with damage to blood forming tissues. May cause anemia and

other blood cell abnormalities. Chronic exposure to benzene has been associated with an increased incidence of leukemia and multiple myeloma (tumor composed of cells of the type normally found in the bone marrow). Immunodepressive effects have been reported. This substance has caused adverse reproductive and fetal effects in laboratory animals.

## Section 4 - First Aid Measures

**Eyes:** In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical aid.  
**Skin:** In case of contact, flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical aid if irritation develops and persists. Wash clothing before reuse.  
**Ingestion:** Potential for aspiration if swallowed. Get medical aid immediately. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person.  
**Inhalation:** If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.  
**Notes to Physician:** Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

**General Information:** As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Use water spray to keep fire-exposed containers cool. Extremely flammable liquid and vapor. Vapor may cause flash fire. Approach fire from upwind to avoid hazardous vapors and toxic decomposition products. Vapors are heavier than air and may travel to a source of ignition and flash back. Vapors can spread along the ground and collect in low or confined areas. This liquid floats on water and may travel to a source of ignition and spread fire. May accumulate static electricity.  
**Extinguishing Media:** Use water spray, dry chemical, carbon dioxide, or appropriate foam.  
**Flash Point:** -11 deg C ( 12.20 deg F)  
**Autoignition Temperature:** 498 deg C ( 928.40 deg F)  
**Explosion Limits, Lower:** 1.3 vol %  
**Upper:** 7.1 vol %  
**NFPA Rating:** (estimated) Health: 2; Flammability: 3; Instability: 0

## Section 6 - Accidental Release Measures

**General Information:** Use proper personal protective equipment as indicated in Section 8.  
**Spills/Leaks:** Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Avoid runoff into storm sewers and ditches which lead to waterways. Remove all sources of ignition. Provide ventilation. Approach spill from upwind. Use water spray to cool and disperse vapors, protect personnel, and dilute spills to form nonflammable mixtures.

## Section 7 - Handling and Storage

**Handling:** Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Ground and bond containers when transferring material. Avoid contact with eyes, skin, and clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Take precautionary measures against static discharges. Keep container tightly closed. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames. Use only with adequate ventilation. Keep away from heat, sparks and flame. Avoid breathing vapor.  
**Storage:** Keep away from sources of ignition. Store in a tightly closed container. Keep from contact with oxidizing materials. Store in a cool, dry, well-ventilated area away from incompatible substances.

## Section 8 - Exposure Controls, Personal Protection

**Engineering Controls:** Use process enclosure, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. Use explosion-proof ventilation equipment. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. See 29CFR 1910.1028 for the regulatory requirements for the control of employee exposure to benzene.

### Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Benzene	0.5 ppm TWA; 2.5 ppm STEL; skin - potential for cutaneous absorption	0.1 ppm TWA 500 ppm IDLH	10 ppm TWA (apply only to exempt industry segments); 25 ppm Ceiling; 1 ppm PEL; 5 ppm STEL; 0.5 ppm Action Level (Cancer hazard,

**OSHA Vacated PELs:** Benzene: 10 ppm TWA (unless specified in 1910.1028)

### Personal Protective Equipment

**Eyes:** Wear chemical goggles.

**Skin:** Wear appropriate protective gloves to prevent skin exposure.

**Clothing:** Wear appropriate protective clothing to prevent skin exposure.

**Respirators:** A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

## Section 9 - Physical and Chemical Properties

**Physical State:** Liquid

**Appearance:** clear colorless

**Odor:** sweetish odor - aromatic odor

**pH:** Not applicable.

**Vapor Pressure:** 75 mm Hg @ 20 deg C

**Vapor Density:** 2.8 (air=1)

**Evaporation Rate:** Not available.

**Viscosity:** 0.647mPa @ 20 deg C

**Boiling Point:** 80.1 deg C

**Freezing/Melting Point:** 5.5 deg C

**Decomposition Temperature:** Not available.

**Solubility:** 0.180 g/100 ml @ 25°C

**Specific Gravity/Density:** 0.8765 @ 20°C

**Molecular Formula:** C<sub>6</sub>H<sub>6</sub>

**Molecular Weight:** 78.11

## Section 10 - Stability and Reactivity

**Chemical Stability:** Stable under normal temperatures and pressures.

**Conditions to Avoid:** Ignition sources, excess heat, confined spaces.

**Incompatibilities with Other Materials:** Strong oxidizing agents.

**Hazardous Decomposition Products:** Carbon monoxide, carbon dioxide.

**Hazardous Polymerization:** Has not been reported.

## Section 11 - Toxicological Information

**RTECS#:****CAS#** 71-43-2: CY1400000**LD50/LC50:**

CAS# 71-43-2:

Dermal, guinea pig: LD50 = &gt;9400 uL/kg;

Draize test, rabbit, eye: 88 mg Moderate;

Draize test, rabbit, eye: 2 mg/24H Severe;

Draize test, rabbit, skin: 20 mg/24H Moderate;

Inhalation, mouse: LC50 = 9980 ppm;

Inhalation, rat: LC50 = 10000 ppm/7H;

Oral, mouse: LD50 = 4700 mg/kg;

Oral, rat: LD50 = 930 mg/kg;

Skin, rabbit: LD50 = &gt;9400 uL/kg;

**Carcinogenicity:**

CAS# 71-43-2:

**ACGIH:** A1 - Confirmed Human Carcinogen**California:** carcinogen, initial date 2/27/87**NIOSH:** potential occupational carcinogen**NTP:** Known carcinogen**OSHA:** Select carcinogen**IARC:** Group 1 carcinogen**Epidemiology:** IARC has concluded that epidemiological studies have established the relationship between benzene exposure and the development of acute myelogenous leukemia, and that there is sufficient evidence that benzene is carcinogenic to humans.**Teratogenicity:** Inhalation, rat: TCLO = 50 ppm/24H (female 7-14 day(s) after conception) Effects on Embryo or Fetus - extra-embryonic structures (e.g., placenta, umbilical cord) and Effects on Embryo or Fetus - fetotoxicity (except death, e.g., stunted fetus).; Inhalation, mouse: TCLO = 5 ppm (female 6-15 day(s) after conception) Effects on Embryo or Fetus - cytological changes (including somatic cell genetic material) and Specific Developmental Abnormalities - blood and lymphatic systems (including spleen and marrow).**Reproductive Effects:** Inhalation, rat: TCLO = 670 mg/m<sup>3</sup>/24H (female 15 day(s) pre-mating and female 1-22 day(s) after conception) female fertility index (e.g. # females pregnant per # sperm positive females; # females pregnant per # females mated).; Oral, mouse: TDLo = 12 gm/kg (female 6-15 day(s) after conception) Fertility - post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants).**Neurotoxicity:** See actual entry in RTECS for complete information.**Mutagenicity:** DNA Inhibition: Human, Leukocyte = 2200 umol/L.; DNA Inhibition: Human, HeLa cell = 2200 umol/L.; Mutation Test Systems - not otherwise specified: Human, Lymphocyte = 5 umol/L.; Cytogenetic Analysis: Inhalation, Human = 125 ppm/1Y.; Cytogenetic Analysis: Human, Leukocyte = 1 mmol/L/72H.; Cytogenetic Analysis: Human, Lymphocyte = 1 mg/L.**Other Studies:** No data available.

## Section 12 - Ecological Information

**Ecotoxicity:** Fish: Mosquito Fish: TLm = 395 mg/L; 24 Hr; Unspecified Fish: Goldfish: LC50 = 46 mg/L; 24 Hr; Modified ASTM D 1345 Fish: Fathead Minnow: LC50 = 15.1 mg/L; 96 Hr; Flow-through at 25°C (pH 7.9-8.0) Fish: Rainbow trout: LC50 = 5.3 mg/L; 96 Hr; Flow-through at 25°C (pH 7.9-8.0) Fish: Bluegill/Sunfish: LD50 = 20 mg/L; 24-48 Hr; Unspecified If benzene is released to soil, it will be subject to rapid volatilization near the surface and that which does not evaporate will be highly to very highly mobile in the soil and may leach to groundwater. If benzene is released to water, it will be subject to rapid volatilization. It will not be expected to significantly adsorb to sediment, bioconcentrate in aquatic organisms or hydrolyze. It may be subject to biodegradation.**Environmental:** If benzene is released to the atmosphere, it will exist predominantly in the vapor phase. Gas-phase benzene will not be subject to direct photolysis but it will react with photochemically produced hydroxyl radicals with a half-life of 13.4 days. The reaction time in polluted atmospheres which contain nitrogen oxides or sulfur dioxide is accelerated with the half-life being reported as 4-6 hours. Benzene is fairly soluble in water and is removed from the atmosphere in rain.**Physical:** Products of photooxidation include phenol, nitrophenols, nitrobenzene, formic acid, and peroxyacetyl nitrate.**Other:** No information available.



## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

**RCRA P-Series:** None listed.

**RCRA U-Series:** CAS# 71-43-2: waste number U019 (Ignitable waste, Toxic waste).

## Section 14 - Transport Information

	US DOT	IATA	RID/ADR	IMO	Canada TDG
<b>Shipping Name:</b>	BENZENE				BENZENE
<b>Hazard Class:</b>	3				3(9.2)
<b>UN Number:</b>	UN1114				UN1114
<b>Packing Group:</b>	II				II
<b>Additional Info:</b>					FLASHPOINT -11 C

## Section 15 - Regulatory Information

### US FEDERAL

#### TSCA

CAS# 71-43-2 is listed on the TSCA inventory.

#### Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

#### Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

#### Section 12b

None of the chemicals are listed under TSCA Section 12b.

#### TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

#### SARA

#### CERCLA Hazardous Substances and corresponding RQs

CAS# 71-43-2: 10 lb final RQ (receives an adjustable RQ of 10 lbs based on potential carc

#### SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

#### SARA Codes

CAS # 71-43-2: acute, chronic, flammable.

#### Section 313

This material contains Benzene (CAS# 71-43-2, 99%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

#### Clean Air Act:

CAS# 71-43-2 is listed as a hazardous air pollutant (HAP). This material does not contain any Class 1 Ozone depleters. This material does not contain any Class 2 Ozone depleters.

#### Clean Water Act:

CAS# 71-43-2 is listed as a Hazardous Substance under the CWA. CAS# 71-43-2 is listed as a Priority Pollutant under the Clean Water Act. CAS# 71-43-2 is listed as a Toxic Pollutant under the Clean Water Act.

#### OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

#### STATE

CAS# 71-43-2 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

**The following statement(s) is(are) made in order to comply with the California Safe Drinking Water**

**Act:** WARNING: This product contains Benzene, a chemical known to the state of California to cause cancer.  
 WARNING: This product contains Benzene, a chemical known to the state of California to cause birth defects or other reproductive harm. California No Significant Risk Level: CAS# 71-43-2: 7 æg/day NSRL

## European/International Regulations

### European Labeling in Accordance with EC Directives

#### Hazard Symbols:

T F

#### Risk Phrases:

R 11 Highly flammable.

R 45 May cause cancer.

R 48/23/24/25 Toxic : danger of serious damage to health by prolonged exposure through inhalation, contact with skin and if swallowed.

#### Safety Phrases:

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S 53 Avoid exposure - obtain special instructions before use.

#### WGK (Water Danger/Protection)

CAS# 71-43-2: 3

#### Canada - DSL/NDSL

CAS# 71-43-2 is listed on Canada's DSL List.

#### Canada - WHMIS

This product has a WHMIS classification of B2, D2A, D2B.

#### Canadian Ingredient Disclosure List

CAS# 71-43-2 is listed on the Canadian Ingredient Disclosure List.

#### Exposure Limits

CAS# 71-43-2: OEL-AUSTRALIA:TWA 5 ppm (16 mg/m<sup>3</sup>);Carcinogen OEL-BELGIUM:TWA 10 ppm (32 mg/m<sup>3</sup>);Carcinogen JAN9 OEL-CZECHOSLOVAKIA:TWA 10 mg/m<sup>3</sup>;STEL 20 mg/m<sup>3</sup> OEL-DENMARK:TWA 5 ppm (16 mg/m<sup>3</sup>);Skin;Carcinogen OEL-FINLAND:TWA 5 ppm (15 mg/m<sup>3</sup>);STEL 10 ppm (30 mg/m<sup>3</sup>);Skin;CAR OEL-FRANCE:TWA 5 ppm (16 mg/m<sup>3</sup>);Carcinogen OEL-GERMANY;Skin;Carcinogen OEL-HUNGARY:STEL 5 mg/m<sup>3</sup>;Skin;Carcinogen OEL-INDIA:TWA 10 ppm (30 mg/m<sup>3</sup>);Carcinogen OEL-JAPAN:TWA 10 ppm (32 mg/m<sup>3</sup>);STEL 25 ppm (80 mg/m<sup>3</sup>);CAR OEL-THE NETHERLANDS:TWA 10 ppm (30 mg/m<sup>3</sup>);Skin OEL-THE PHILIPPINES:TWA 25 ppm (80 mg/m<sup>3</sup>);Skin OEL-POLAND:TWA 30 mg/m<sup>3</sup>;Skin OEL-RUSSIA:TWA 10 ppm (5 mg/m<sup>3</sup>);STEL 25 ppm (15 mg/m<sup>3</sup>);Skin;CAR OEL-SWEDEN:TWA 1 ppm (3 mg/m<sup>3</sup>);STEL 5 ppm (16 mg/m<sup>3</sup>);Skin;CAR OEL-SWITZERLAND:TWA 5 ppm (16 mg/m<sup>3</sup>);Skin;Carcinogen OEL-THAILAND:TWA 10 ppm (30 mg/m<sup>3</sup>);STEL 25 ppm (7 mg/m<sup>3</sup>) OEL-TURKEY:TWA 20 ppm (64 mg/m<sup>3</sup>);Skin OEL-UNITED KINGDOM:TWA 10 ppm (30 mg/m<sup>3</sup>) OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV



## Section 16 - Additional Information

**MSDS Creation Date:** 6/11/1999

**Revision #6 Date:** 1/29/2004

*The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.*

MSDS Number: **C2475** \* \* \* \* \* *Effective Date: 02/18/03* \* \* \* \* \* *Supersedes: 04/04/00*

<b>MSDS</b>	<b>Material Safety Data Sheet</b>	24 Hour Emergency Telephone: 908-859-2151 CHEMTREC: 1-800-424-9300	
		National Response in Canada CANUTEC: 613-996-6666	
		Outside U.S. and Canada Chemtec: 703-527-3887	
		<b>NOTE:</b> CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.	
From: Mallinckrodt Baker, Inc. 222 Red School Lane Phillipsburg, NJ 08865		 <b>Mallinckrodt CHEMICALS</b>	
All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.			

# CHLOROBENZENE

## 1. Product Identification

**Synonyms:** Monochlorobenzene; Chlorobenzol; Phenyl chloride; Benzene chloride

**CAS No.:** 108-90-7

**Molecular Weight:** 112.56

**Chemical Formula:** C<sub>6</sub>H<sub>5</sub>Cl

**Product Codes:**

J.T. Baker: 5153, 5163, 9179

Mallinckrodt: 4419, 4426

## 2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Chlorobenzene	108-90-7	99 - 100%	Yes

## 3. Hazards Identification

### Emergency Overview

**WARNING! FLAMMABLE LIQUID AND VAPOR. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM AND LIVER.**

**J.T. Baker SAF-T-DATA<sup>(tm)</sup>** Ratings (Provided here for your convenience)

---

Health Rating: 2 - Moderate  
Flammability Rating: 3 - Severe (Flammable)  
Reactivity Rating: 1 - Slight  
Contact Rating: 2 - Moderate  
Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES; CLASS B  
EXTINGUISHER.  
Storage Color Code: Red (Flammable)

---

### Potential Health Effects

---

#### **Inhalation:**

Causes irritation to the respiratory tract. Symptoms may include coughing, shortness of breath. Affects central nervous system causing dizziness, incoordination and unconsciousness.

#### **Ingestion:**

Causes irritation to the gastrointestinal tract. Symptoms may include nausea, vomiting and diarrhea. Toxic! May cause systemic poisoning with symptoms paralleling those of inhalation.

#### **Skin Contact:**

Causes irritation to skin. Symptoms include redness, itching, and pain. May be slowly absorbed through the skin with possible systemic effects.

#### **Eye Contact:**

Vapors cause eye irritation. Splashes cause severe irritation, possible corneal burns and eye damage.

#### **Chronic Exposure:**

Prolonged or repeated skin exposure may cause dermatitis or skin burns. Prolonged or repeated exposure may cause liver, kidney, or lung damage.

#### **Aggravation of Pre-existing Conditions:**

Persons with pre-existing skin, eye or central nervous system disorders, or impaired liver, kidney, or pulmonary function may be more susceptible to the effects of this substance.

---

## 4. First Aid Measures

#### **Inhalation:**

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

#### **Ingestion:**

Give large amounts of water to drink. Never give anything by mouth to an unconscious person. Get medical attention.

#### **Skin Contact:**

Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.

#### **Eye Contact:**

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

---

## 5. Fire Fighting Measures

#### **Fire:**

Flash point: 28C (82F) CC

Autoignition temperature: 593C (1099F)

Flammable limits in air % by volume:

lcl: 1.3; ucl: 9.6

Flammable Liquid

**Explosion:**

Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Reactions with incompatibles may pose an explosion hazard. Vapors can flow along surfaces to distant ignition source and flash back. Sealed containers may rupture when heated. Sensitive to static discharge.

**Fire Extinguishing Media:**

Dry chemical, foam or carbon dioxide. Water spray may be used to keep fire exposed containers cool, dilute spills to nonflammable mixtures, protect personnel attempting to stop leak and disperse vapors.

**Special Information:**

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. This highly flammable liquid must be kept from sparks, open flame, hot surfaces, and all sources of heat and ignition. Combustion by-products include phosgene and hydrogen chloride gases.

---

## 6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker SOLUSORB® solvent adsorbent is recommended for spills of this product.

---

## 7. Handling and Storage

Protect against physical damage. Outside or detached storage is preferred. Inside storage should be in a standard flammable liquids storage room or cabinet. Separate from oxidizing materials. Storage and use areas should be No Smoking areas. Containers should be bonded and grounded for transfers to avoid static sparks. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

---

## 8. Exposure Controls/Personal Protection

**Airborne Exposure Limits:**

-OSHA Permissible Exposure Limit (PEL):

75 ppm (TWA)

-ACGIH Threshold Limit Value (TLV):

10 ppm (TWA)

**Ventilation System:**

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

**Personal Respirators (NIOSH Approved):**

If the exposure limit is exceeded and engineering controls are not feasible, a half-face organic vapor respirator may be worn for up to ten times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece organic vapor respirator may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. **WARNING:** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

**Skin Protection:**

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

**Eye Protection:**

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

## 9. Physical and Chemical Properties

**Appearance:**

Clear, colorless liquid.

**Odor:**

Faint, almond like odor.

**Solubility:**

Insoluble in water.

**Specific Gravity:**

1.11 @ 20C/4C

**pH:**

No information found.

**% Volatiles by volume @ 21C (70F):**

100

**Boiling Point:**

132C (270F)

**Melting Point:**

-45C (-49F)

**Vapor Density (Air=1):**

3.9

**Vapor Pressure (mm Hg):**

11.8 @ 25C (77F)

**Evaporation Rate (BuAc=1):**

1.1

---

## 10. Stability and Reactivity

**Stability:**

Stable under ordinary conditions of use and storage.

**Hazardous Decomposition Products:**

May produce carbon monoxide, carbon dioxide, hydrogen chloride and phosgene when heated to decomposition.

**Hazardous Polymerization:**

Will not occur.

**Incompatibilities:**

Oxidizing agents, dimethyl sulfoxide, silver perchlorate, silver chromate.

**Conditions to Avoid:**

Heat, flames, ignition sources and incompatibles.

---

## 11. Toxicological Information

For Chlorobenzene: Oral rat LD50: 1110 mg/kg; Inhalation rat LC50: 2965 ppm. Investigated as a tumorigen, mutagen, reproductive effector.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Chlorobenzene (108-90-7)	No	No	None

---

## 12. Ecological Information

**Environmental Fate:**

When released into the soil, this material may evaporate to a moderate extent. When released into the soil, this material is not expected to biodegrade. When released into the soil, this material may leach into groundwater. When released to water, this material is expected to quickly evaporate. When released into the water, this material is expected to have a half-life of less than 1 day. When released into water, this material is not expected to biodegrade. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life between 1 and 10 days.

**Environmental Toxicity:**

The LC50/96-hour values for fish are between 10 and 100 mg/l. This material is expected to be slightly toxic to aquatic life.

---

## 13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

---

## 14. Transport Information

**Domestic (Land, D.O.T.)****Proper Shipping Name:** RQ, CHLOROBENZENE**Hazard Class:** 3**UN/NA:** UN1134**Packing Group:** III**Information reported for product/size:** 52L**International (Water, I.M.O.)****Proper Shipping Name:** CHLOROBENZENE**Hazard Class:** 3**UN/NA:** UN1134**Packing Group:** III**Information reported for product/size:** 52L**International (Air, I.C.A.O.)****Proper Shipping Name:** CHLOROBENZENE**Hazard Class:** 3**UN/NA:** UN1134**Packing Group:** III**Information reported for product/size:** 52L

## 15. Regulatory Information

```

-----\Chemical Inventory Status - Part 1\-----
Ingredient                                     TSCA   EC     Japan  Australia
-----
Chlorobenzene (108-90-7)                     Yes   Yes   Yes     Yes

```

```

-----\Chemical Inventory Status - Part 2\-----
Ingredient                                     Korea  --Canada--
                                     DSL    NDSL   Phil.
-----
Chlorobenzene (108-90-7)                     Yes   Yes   No     Yes

```

```

-----\Federal, State & International Regulations - Part 1\-----
Ingredient                                     -SARA 302-  -SARA 313-
                                     RQ    TPQ    List  Chemical Catg.
-----
Chlorobenzene (108-90-7)                     No    No     Yes     No

```

```

-----\Federal, State & International Regulations - Part 2\-----
Ingredient                                     CERCLA  -RCRA-  -TSCA-
                                     261.33  8(d)
-----
Chlorobenzene (108-90-7)                     100     U037    Yes

```

Chemical Weapons Convention: No      TSCA 12(b): No      CDTA: Yes  
 SARA 311/312: Acute: Yes      Chronic: Yes      Fire: Yes      Pressure: No  
 Reactivity: No      (Pure / Liquid)

**Australian Hazchem Code:** 2Y  
**Poison Schedule:** None allocated.



**WHMIS:**

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

## 16. Other Information

**NFPA Ratings:** Health: **2** Flammability: **3** Reactivity: **0**

**Label Hazard Warning:**

WARNING! FLAMMABLE LIQUID AND VAPOR. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM AND LIVER.

**Label Precautions:**

Keep away from heat, sparks and flame.  
Avoid breathing vapor.  
Keep container closed.  
Wash thoroughly after handling.  
Avoid contact with eyes, skin and clothing.  
Use only with adequate ventilation.

**Label First Aid:**

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, give large amounts of water to drink. Never give anything by mouth to an unconscious person. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.

**Product Use:**

Laboratory Reagent.

**Revision Information:**

MSDS Section(s) changed since last revision of document include: 8.

**Disclaimer:**

\*\*\*\*\*

**Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.**

\*\*\*\*\*

**Prepared by:** Environmental Health & Safety

Phone Number: (314) 654-1600 (U.S.A.)

---

MSDS Number: **C4356** \* \* \* \* \* *Effective Date: 02/18/03* \* \* \* \* \* *Supercedes: 03/01/00*

---

**Material Safety Data Sheet**

From: Mallinckrodt Baker, Inc.  
222 Red School Lane  
Phillipsburg, NJ 08865



24 Hour Emergency Telephone: 908-859-2151  
CHEMTREC: 1-800-424-9300  
National Response in Canada  
CANUTEC: 613-996-6666  
Outside U.S. And Canada  
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

---

# Chromium Oxide

---

## 1. Product Identification

**Synonyms:** Chromium (III) Oxide; Chromic Oxide; Chrome Oxide Green

**CAS No.:** 1308-38-9

**Molecular Weight:** 151.99

**Chemical Formula:** Cr<sub>2</sub>O<sub>3</sub>

**Product Codes:** 1616

---

## 2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
-----	-----	-----	-----
Chromium (III) Oxide	1308-38-9	90 - 100%	Yes

---

## 3. Hazards Identification

### Emergency Overview

**WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.**

**J.T. Baker SAF-T-DATA<sup>(tm)</sup>** Ratings (Provided here for your convenience)

Health Rating: 2 - Moderate

Flammability Rating: 0 - None

Reactivity Rating: 1 - Slight

Contact Rating: 2 - Moderate

Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES

Storage Color Code: Blue (Health)

---

### **Potential Health Effects**

---

**Inhalation:**

Causes irritation to the respiratory tract. Symptoms may include coughing, shortness of breath.

**Ingestion:**

Causes irritation to the gastrointestinal tract. Symptoms may include nausea, vomiting and diarrhea.

**Skin Contact:**

Causes irritation to skin. Symptoms include redness, itching, and pain.

**Eye Contact:**

Causes irritation, redness, and pain.

**Chronic Exposure:**

Prolonged or repeated skin contact may produce severe irritation or dermatitis.

**Aggravation of Pre-existing Conditions:**

No information found.

---

## **4. First Aid Measures**

**Inhalation:**

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

**Ingestion:**

Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention.

**Skin Contact:**

Immediately flush skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.

**Eye Contact:**

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

---

## **5. Fire Fighting Measures**

**Fire:**

Not considered to be a fire hazard.

**Explosion:**

Not considered to be an explosion hazard.

**Fire Extinguishing Media:**

Use any means suitable for extinguishing surrounding fire.

**Special Information:**

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

---

## 6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8.

Spills: Pick up and place in a suitable container for reclamation or disposal in a method that does not generate dust. Do not sweep. Damp mop any residue.

---

## 7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Do not store on wooden floors. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

---

## 8. Exposure Controls/Personal Protection

### **Airborne Exposure Limits:**

-OSHA Permissible Exposure Limit (PEL):  
for Cr(III) compounds = 0.5mg/m<sup>3</sup> (TWA)

-ACGIH Threshold Limit Value (TLV):

for Cr(III) compounds = 0.5 mg/m<sup>3</sup> (TWA), A4 - Not classifiable as a human carcinogen

### **Ventilation System:**

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

### **Personal Respirators (NIOSH Approved):**

If the exposure limit is exceeded and engineering controls are not feasible, a half facepiece particulate respirator (NIOSH type N95 or better filters) may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest.. A full-face piece particulate respirator (NIOSH type N100 filters) may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency, or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P filter. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. **WARNING:** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

### **Skin Protection:**

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

### **Eye Protection:**

Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

## 9. Physical and Chemical Properties

**Appearance:**

Light to dark green Crystalline solid.

**Odor:**

Odorless.

**Solubility:**

Negligible (&lt; 0.1%)

**Specific Gravity:**

5.10

**pH:**

No information found.

**% Volatiles by volume @ 21C (70F):**

0

**Boiling Point:**

4000C (7232F)

**Melting Point:**

2435C (4415F)

**Vapor Density (Air=1):**

Not applicable.

**Vapor Pressure (mm Hg):**

Not applicable.

**Evaporation Rate (BuAc=1):**

No information found.

---

## 10. Stability and Reactivity

**Stability:**

Stable under ordinary conditions of use and storage.

**Hazardous Decomposition Products:**

No information found.

**Hazardous Polymerization:**

Will not occur.

**Incompatibilities:**

Lithium, glycerol.

**Conditions to Avoid:**

Dusting.

---

## 11. Toxicological Information

Investigated as a tumorigen, mutagen.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Chromium (III) Oxide (1308-38-9)	No	No	3

---

## 12. Ecological Information

**Environmental Fate:**

When released into the soil, this material is not expected to biodegrade. This material is not expected to significantly bioaccumulate.

**Environmental Toxicity:**

No information found.

---

## 13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

---

## 14. Transport Information

Not regulated.

---

## 15. Regulatory Information

```
-----\Chemical Inventory Status - Part 1\-----
Ingredient                                     TSCA   EC    Japan  Australia
-----
Chromium (III) Oxide (1308-38-9)             Yes   Yes   Yes    Yes
```

```
-----\Chemical Inventory Status - Part 2\-----
Ingredient                                     Korea  --Canada--
                                     DSL    NDSL   Phil.
-----
Chromium (III) Oxide (1308-38-9)             Yes   Yes   No     Yes
```

```
-----\Federal, State & International Regulations - Part 1\-----
Ingredient                                     -SARA 302-  -----SARA 313-----
                                     RQ    TPQ      List  Chemical Catg.
-----
Chromium (III) Oxide (1308-38-9)             No     No       No    Chromium com
```

```
-----\Federal, State & International Regulations - Part 2\-----
Ingredient                                     CERCLA      -RCRA-      -TSCA-
                                     261.33     8(d)
-----
Chromium (III) Oxide (1308-38-9)             No          No          No
```

Chemical Weapons Convention: No      TSCA 12(b): No      CDTA: No  
SARA 311/312: Acute: Yes      Chronic: Yes      Fire: No      Pressure: No  
Reactivity: No      (Pure / Solid)

**Australian Hazchem Code:** None allocated.

**Poison Schedule:** None allocated.

**WHMIS:**

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

## 16. Other Information

### **Label Hazard Warning:**

WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.

### **Label Precautions:**

Avoid contact with eyes, skin and clothing.

Wash thoroughly after handling.

Avoid breathing dust.

Keep container closed.

Use only with adequate ventilation.

### **Label First Aid:**

If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, wipe off excess material from skin then immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.

### **Product Use:**

Laboratory Reagent.

### **Revision Information:**

MSDS Section(s) changed since last revision of document include: 8.

### **Disclaimer:**

\*\*\*\*\*



**Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.**

\*\*\*\*\*

**Prepared by:** Environmental Health & Safety

Phone Number: (314) 654-1600 (U.S.A.)

MSDS Number: **C4400** \* \* \* \* \* *Effective Date: 07/29/03* \* \* \* \* \* *Supersedes: 10/31/00*

<b>MSDS</b>	<b>Material Safety Data Sheet</b>	24 Hour Emergency Telephone: 908-859-2151 CHEMTREC: 1-800-424-9300	
		National Response in Canada CANUTEC: 613-996-6666	
		Outside U.S. and Canada Chemtec: 703-527-3887	
		<b>NOTE:</b> CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.	
From: Mallinckrodt Baker, Inc. 222 Red School Lane Phillipsburg, NJ 08865		 <b>Mallinckrodt CHEMICALS</b>	
All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.			

# CHROMIUM TRIOXIDE

## 1. Product Identification

**Synonyms:** Chromium (VI) oxide (1:3); chromic acid, solid; chromic anhydride

**CAS No.:** 1333-82-0

**Molecular Weight:** 99.99

**Chemical Formula:** CrO<sub>3</sub>

**Product Codes:**

J.T. Baker: 1637, 1638, 1639, 1642

Mallinckrodt: 2564, 2576

## 2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Chromium(VI) Oxide (1:3)	1333-82-0	99 - 100%	Yes

## 3. Hazards Identification

### Emergency Overview

**DANGER! STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE A FIRE. CORROSIVE. CAUSES SEVERE BURNS TO EVERY AREA OF CONTACT. HARMFUL IF SWALLOWED OR INHALED. AFFECTS THE RESPIRATORY SYSTEM, LIVER, KIDNEYS, EYES, SKIN AND BLOOD. MAY CAUSE ALLERGIC REACTION. CANCER HAZARD. CAN CAUSE CANCER. Risk of cancer depends on duration and level of exposure.**



**J.T. Baker SAF-T-DATA<sup>(tm)</sup>** Ratings (Provided here for your convenience)

---

Health Rating: 4 - Extreme (Cancer Causing)

Flammability Rating: 0 - None

Reactivity Rating: 3 - Severe (Oxidizer)

Contact Rating: 3 - Severe (Corrosive)

Lab Protective Equip: GOGGLES; LAB COAT; PROPER GLOVES

Storage Color Code: Yellow (Reactive)

---

**Potential Health Effects**

---

**Inhalation:**

Corrosive. Extremely destructive to tissues of the mucous membranes and upper respiratory tract. May cause ulceration and perforation of the nasal septum. Symptoms may include sore throat, coughing, shortness of breath, and labored breathing. May produce pulmonary sensitization or allergic asthma. Higher exposures may cause pulmonary edema.

**Ingestion:**

Corrosive. Swallowing can cause severe burns of the mouth, throat, and stomach, leading to death. Can cause sore throat, vomiting, diarrhea. May cause violent gastroenteritis, peripheral vascular collapse, dizziness, intense thirst, muscle cramps, shock, coma, abnormal bleeding, fever, liver damage and acute renal failure.

**Skin Contact:**

Corrosive. Symptoms of redness, pain, and severe burn can occur. Dusts and strong solutions may cause severe irritation. Contact with broken skin may cause ulcers (chrome sores) and absorption, which may cause systemic poisoning, affecting kidney and liver functions. May cause skin sensitization.

**Eye Contact:**

Corrosive. Contact can cause blurred vision, redness, pain and severe tissue burns. May cause corneal injury or blindness.

**Chronic Exposure:**

Repeated or prolonged exposure can cause ulceration and perforation of the nasal septum, respiratory irritation, liver and kidney damage and ulceration of the skin. Ulcerations at first may be painless, but may penetrate to the bone producing "chrome holes." Known to be a human carcinogen.

**Aggravation of Pre-existing Conditions:**

Persons with pre-existing skin disorders, asthma, allergies or known sensitization to chromic acid or chromates may be more susceptible to the effects of this material.

---

## 4. First Aid Measures

**Inhalation:**

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

**Ingestion:**

If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.

**Skin Contact:**

Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention immediately. Wash clothing before reuse. Thoroughly clean shoes before reuse.

**Eye Contact:**

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids

occasionally. Get medical attention immediately.

---

## 5. Fire Fighting Measures

### **Fire:**

Not combustible, but substance is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition. Will ignite on contact with acetic acid and alcohol. Releases oxygen upon decomposition, increasing the fire hazard.

### **Explosion:**

Contact with oxidizable substances may cause extremely violent combustion. Containers may explode when involved in a fire.

### **Fire Extinguishing Media:**

Use water, however, the decomposing material will form a hot viscous foam and caution should be exercised against the possibility of a steam explosion.

### **Special Information:**

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

---

## 6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8.

Spills: Sweep up and containerize for reclamation or disposal. Vacuuming or wet sweeping may be used to avoid dust dispersal. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

---

## 7. Handling and Storage

Keep in a tightly closed container. Protect from physical damage. Store in a cool, dry, ventilated area away from sources of heat, ignition sources, moisture and incompatibilities. Do not store on wooden floors.

Wear special protective equipment (Sec. 8) for maintenance break-in or where exposures may exceed established exposure levels. Wash hands, face, forearms and neck when exiting restricted areas. Shower, dispose of outer clothing, change to clean garments at the end of the day. Avoid cross-contamination of street clothes. Wash hands before eating and do not eat, drink, or smoke in workplace. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

---

## 8. Exposure Controls/Personal Protection

### **Airborne Exposure Limits:**

- OSHA Permissible Exposure Limit (PEL):

For chromic acid and chromates, as  $\text{CrO}_3 = 0.1 \text{ mg/m}^3$  (ceiling)

- ACGIH Threshold Limit Value (TLV):

For water-soluble  $\text{Cr(VI)}$  compounds, as  $\text{Cr} = 0.05 \text{ mg/m}^3$  (TWA), A1 - confirmed human carcinogen.

### **Ventilation System:**

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

**Personal Respirators (NIOSH Approved):**

If the exposure limit is exceeded and engineering controls are not feasible, a half facepiece particulate respirator (NIOSH type N95 or better filters) may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest.. A full-face piece particulate respirator (NIOSH type N100 filters) may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency, or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P filter. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. **WARNING:** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

**Skin Protection:**

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

**Eye Protection:**

Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

## 9. Physical and Chemical Properties

**Appearance:**

Dark red deliquescent solid.

**Odor:**

Odorless.

**Solubility:**

63g/100g water @ 20C (68F)

**Specific Gravity:**

2.7

**pH:**

No information found.

**% Volatiles by volume @ 21C (70F):**

No information found.

**Boiling Point:**

Decomposes on melting

**Melting Point:**

197C (387F)

**Vapor Density (Air=1):**

No information found.

**Vapor Pressure (mm Hg):**

No information found.

**Evaporation Rate (BuAc=1):**

No information found.

---

## 10. Stability and Reactivity

**Stability:**

Stable under ordinary conditions of use and storage.

**Hazardous Decomposition Products:**

Burning may produce chrome oxides.

**Hazardous Polymerization:**

Will not occur.

**Incompatibilities:**

Any combustible, organic or other readily oxidizable material (paper, wood, sulfur, aluminum or plastics). Incompatible with arsenic, ammonia gas, hydrogen sulfide, phosphorus potassium; sodium and selenium will produce incandescence. Corrosive to metals.

**Conditions to Avoid:**

Avoid excess heat and contact with combustible or organic materials.

---

## 11. Toxicological Information

Oral rat LD50: 80 mg/kg Investigated as a tumorigen, mutagen, reproductive effector.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Chromium(VI) Oxide (1:3) (1333-82-0)	Yes	No	1

---

## 12. Ecological Information

**Environmental Fate:**

When released into the soil, this material may leach into groundwater. When released into water, this material is not expected to evaporate significantly. When released into the air, this material may be removed from the atmosphere to a moderate extent by wet deposition.

**Environmental Toxicity:**

This material is expected to be toxic to aquatic life.

---

## 13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

---

## 14. Transport Information

**Domestic (Land, D.O.T.)**

-----

**Proper Shipping Name:** CHROMIUM TRIOXIDE, ANHYDROUS

**Hazard Class:** 5.1, 8

**UN/NA:** UN1463

**Packing Group:** II

Information reported for product/size: 100LB

International (Water, I.M.O.)

-----  
Proper Shipping Name: CHROMIUM TRIOXIDE, ANHYDROUS

Hazard Class: 5.1, 8

UN/NA: UN1463

Packing Group: II

Information reported for product/size: 100LB

---

## 15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----  
Ingredient TSCA EC Japan Australia  
-----  
Chromium(VI) Oxide (1:3) (1333-82-0) Yes Yes Yes Yes

-----\Chemical Inventory Status - Part 2\-----  
Ingredient Korea DSL --Canada-- NDSL Phil.  
-----  
Chromium(VI) Oxide (1:3) (1333-82-0) Yes Yes No Yes

-----\Federal, State & International Regulations - Part 1\-----  
Ingredient -SARA 302- -----SARA 313-----  
RQ TPQ List Chemical Catg.  
-----  
Chromium(VI) Oxide (1:3) (1333-82-0) No No No Chromium com

-----\Federal, State & International Regulations - Part 2\-----  
Ingredient CERCLA -RCRA- -TSCA-  
261.33 8(d)  
-----  
Chromium(VI) Oxide (1:3) (1333-82-0) No No No

Chemical Weapons Convention: No TSCA 12(b): Yes CDTA: Yes  
SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No  
Reactivity: Yes (Pure / Solid)

### WARNING:

THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: 2W

Poison Schedule: S6

### WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

## 16. Other Information

NFPA Ratings: Health: 3 Flammability: 0 Reactivity: 1 Other: Oxidizer

### Label Hazard Warning:

DANGER! STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE A FIRE.

CORROSIVE. CAUSES SEVERE BURNS TO EVERY AREA OF CONTACT. HARMFUL IF SWALLOWED OR INHALED. AFFECTS THE RESPIRATORY SYSTEM, LIVER, KIDNEYS, EYES, SKIN AND BLOOD. MAY CAUSE ALLERGIC REACTION. CANCER HAZARD. CAN CAUSE CANCER. Risk of cancer depends on duration and level of exposure.

**Label Precautions:**

Keep from contact with clothing and other combustible materials.

Do not get in eyes, on skin, or on clothing.

Do not breathe dust or mist from solutions.

Store in a tightly closed container.

Keep container closed.

Use only with adequate ventilation.

Wash thoroughly after handling.

Do not store near combustible materials.

**Label First Aid:**

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. In all cases get medical attention immediately.

**Product Use:**

Laboratory Reagent.

**Revision Information:**

MSDS Section(s) changed since last revision of document include: 8.

**Disclaimer:**

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**Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.**

\*\*\*\*\*

**Prepared by:** Environmental Health & Safety

Phone Number: (314) 654-1600 (U.S.A.)

# International Chemical Safety Cards

## 2,3,7,8-TETRACHLORODIBENZO-p-DIOXIN

ICSC: 1467



Dibenzo b,e 1,4dioxin, 2,3,7,8-tetrachloro-  
2,3,7,8-TCDD  
2,3,7,8-Tetrachloro-1,4-dioxin  
 $C_{12}H_4Cl_4O_2$   
Molecular mass: 322

ICSC # 1467

CAS # 1746-01-6

RTECS # [HP3500000](#)

UN # 2811

November 26, 2003 Peer reviewed



TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
<b>FIRE</b>	Gives off irritating or toxic fumes (or gases) in a fire.		In case of fire in the surroundings: powder, water spray, foam, carbon dioxide.
<b>EXPLOSION</b>			
<b>EXPOSURE</b>		AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
• <b>INHALATION</b>	Chloracne. Symptoms may be delayed.	Use appropriate engineering controls.	Fresh air, rest. Refer for medical attention.
• <b>SKIN</b>	MAY BE ABSORBED! (See Inhalation). Redness. Pain.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.
• <b>EYES</b>	Redness. Pain.	Face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• <b>INGESTION</b>	(See Inhalation).	Do not eat, drink, or smoke during work. Wash hands before eating.	Give a slurry of activated charcoal in water to drink. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.


SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Evacuate danger area! Consult an expert! Chemical protection suit including self-contained breathing apparatus.	Separated from food and feedstuffs.	R: S: UN Hazard Class: 6.1 UN Packing Group: I

### SEE IMPORTANT INFORMATION ON BACK

ICSC: 1467

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

**2,3,7,8-TETRACHLORODIBENZO-p-DIOXIN****ICSC: 1467**

<b>I M P O R T A N T  D A T A</b>	<p><b>PHYSICAL STATE; APPEARANCE:</b> COLOURLESS TO WHITE NEEDLE-LIKE CRYSTALS</p> <p><b>PHYSICAL DANGERS:</b></p> <p><b>CHEMICAL DANGERS:</b> The substance decomposes on heating to 750-800°C and under the influence of UV light producing chlorine .</p> <p><b>OCCUPATIONAL EXPOSURE LIMITS (OELs):</b> TLV not established. MAK: 10-8 mg/m<sup>3</sup>; H; Peak limitation category: II(8); Carcinogen category: 4; Pregnancy risk group: C; (DFG 2003).</p> <p><b>ROUTES OF EXPOSURE:</b> The substance can be absorbed into the body by inhalation of dust, through the skin and by ingestion .</p> <p><b>INHALATION RISK:</b> Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly when dispersed.</p> <p><b>EFFECTS OF SHORT-TERM EXPOSURE:</b> The substance is irritating to the eyes , the skin and the respiratory tract . The substance may cause effects on the cardiovascular system , gastrointestinal tract , liver , nervous system and endocrine system . The effects may be delayed.</p> <p><b>EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:</b> Repeated or prolonged contact with skin may cause dermatitis. The substance may have effects on the bone marrow , endocrine system , immune system , liver and nervous system . This substance is carcinogenic to humans. Animal tests show that this substance possibly causes toxicity to human reproduction or development.</p>
<b>PHYSICAL PROPERTIES</b>	<p>Melting point: 305-306°C Density: 1.8 g/cm<sup>3</sup></p> <p>Solubility in water: none Vapour pressure, Pa at 25°C: negligible Octanol/water partition coefficient as log Pow: 6.8-7.02</p>
<b>ENVIRONMENTAL DATA</b>	<p>The substance is very toxic to aquatic organisms. This substance may be hazardous in the environment; special attention should be given to soil contamination. Bioaccumulation of this chemical may occur in fish,in plants,in mammals and in milk. It is strongly advised that this substance does not enter the environment.</p> 
<b>NOTES</b>	
<p>This chemical is only produced for research purposes, but could be generated as a by-product from chemical processes or fires.</p> <p>Transport Emergency Card: TEC (R)-61GT2-I</p>	
<b>ADDITIONAL INFORMATION</b>	
<b>ICSC: 1467</b> <b>2,3,7,8-TETRACHLORODIBENZO-p-DIOXIN</b> (C) IPCS, CEC, 1994	

<b>IMPORTANT LEGAL NOTICE:</b>	<p>Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and NIOSH IDLH values.</p>
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MSDS Number: **E3050** \* \* \* \* \* *Effective Date: 01/31/05* \* \* \* \* \* *Supersedes: 11/04/04*

---

**Material Safety Data Sheet**

From: Mallinckrodt Baker, Inc.  
222 Red School Lane  
Phillipsburg, NJ 08865



Mallinckrodt  
CHEMICALS



24 Hour Emergency Telephone: 908-859-2151  
CHEMTREC: 1-800-424-9300

National Response in Canada  
CANUTEC: 613-996-6666

Outside U.S. and Canada  
Chemtec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

---

# ETHYL BENZENE

---

## 1. Product Identification

**Synonyms:** Benzene, ethyl; ethylbenzen 99%; ethyl benzol

**CAS No.:** 100-41-4

**Molecular Weight:** 106.17

**Chemical Formula:** C<sub>6</sub>H<sub>5</sub>C<sub>2</sub>H<sub>5</sub>

**Product Codes:**

J.T. Baker: 5156, 5166

Mallinckrodt: 2427

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## 2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
-----	-----	-----	-----
Ethyl Benzene	100-41-4	100%	Yes

---

## 3. Hazards Identification

### Emergency Overview

-----

**WARNING! FLAMMABLE LIQUID AND VAPOR. HARMFUL IF SWALLOWED OR INHALED. VAPOR OR MIST IS IRRITATING TO THE EYES AND UPPER RESPIRATORY TRACT. CAUSES SKIN IRRITATION. AFFECTS CENTRAL NERVOUS SYSTEM.**

**SAF-T-DATA<sup>(tm)</sup>** Ratings (Provided here for your convenience)

-----

Health Rating: 2 - Moderate (Life)

Flammability Rating: 3 - Severe (Flammable)

Reactivity Rating: 1 - Slight

Contact Rating: 2 - Moderate

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD;  
PROPER GLOVES; CLASS B EXTINGUISHER

Storage Color Code: Red (Flammable)

-----

### **Potential Health Effects**

-----

#### **Inhalation:**

Vapors irritate the mucous membranes and respiratory tract. May cause coughing, headache, Labored breathing, dizziness and unconsciousness. May affect blood circulation.

#### **Ingestion:**

Harmful if swallowed. Aspiration into the lungs may cause pneumonia. Abdominal pain, nausea, vomiting may occur. May affect central nervous system.

#### **Skin Contact:**

Causes irritation with redness and pain. Prolonged contact may cause dermatitis.

#### **Eye Contact:**

Vapors irritate the eyes, causing redness, pain, blurred vision.

#### **Chronic Exposure:**

Chronic exposure may cause fatigue, sleepiness, headache, and irritation of the eyes, respiratory tract and skin.

#### **Aggravation of Pre-existing Conditions:**

Persons with pre-existing skin disorders or eye problems, or impaired liver, kidney or respiratory function may be more susceptible to the effects of the substance.

---

## **4. First Aid Measures**

#### **Inhalation:**

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

#### **Ingestion:**

Aspiration hazard. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.

#### **Skin Contact:**

Immediately flush skin with plenty of water for at least 15 minutes. Remove

contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.

**Eye Contact:**

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

---

## 5. Fire Fighting Measures

**Fire:**

Flash point: 21C (70F) CC

Autoignition temperature: 432C (810F)

Flammable limits in air % by volume:

lcl: 0.8; ucl: 6.7

Flammable Liquid and Vapor! Liquid floats on water and may travel to a source of ignition and spread the fire.

**Explosion:**

Sealed containers may rupture when heated. Above the flash point, explosive vapor-air mixtures may be formed. Vapors can flow along surfaces to distant ignition source and flash back. Sensitive to static discharge.

**Fire Extinguishing Media:**

Dry chemical, alcohol foam or carbon dioxide. Water may be ineffective. Water spray may be used to keep fire exposed containers cool.

**Special Information:**

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Vapors can flow along surfaces to distant ignition source and flash back.

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## 6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

---

## 7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product. Do Not attempt to clean empty containers since residue is difficult to remove. Do not pressurize, cut, weld, braze, solder, drill, grind or expose such containers to heat, sparks, flame, static electricity or other sources of ignition: they may explode and cause injury or death.

---

## 8. Exposure Controls/Personal Protection

### **Airborne Exposure Limits:**

For Ethyl Benzene:

- OSHA Permissible Exposure Limit (PEL) - 100 ppm (TWA)

- ACGIH Threshold Limit Value (TLV) -

100 ppm (TWA) 125 ppm (STEL), A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans.

### **Ventilation System:**

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

### **Personal Respirators (NIOSH Approved):**

If the exposure limit is exceeded and engineering controls are not feasible, a half-face organic vapor respirator may be worn for up to ten times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece organic vapor respirator may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. **WARNING:** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres. Where respirators are required, you must have a written program covering the basic requirements in the OSHA respirator standard. These include training, fit testing, medical approval, cleaning, maintenance, cartridge change schedules, etc. See 29CFR1910.134 for details.

### **Skin Protection:**

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

**Eye Protection:**

Use chemical safety goggles and/or a full face shield where splashing is possible.  
Maintain eye wash fountain and quick-drench facilities in work area.

---

## 9. Physical and Chemical Properties

**Appearance:**

Clear, colorless liquid.

**Odor:**

Aromatic odor.

**Solubility:**

Insoluble in water.

**Specific Gravity:**

0.867 @ 20C/4C

**pH:**

No information found.

**% Volatiles by volume @ 21C (70F):**

No information found.

**Boiling Point:**

136C (277F)

**Melting Point:**

-95C (-139F)

**Vapor Density (Air=1):**

3.66

**Vapor Pressure (mm Hg):**

10 @ 25.9C (79F)

**Evaporation Rate (BuAc=1):**

< 1

---

## 10. Stability and Reactivity

**Stability:**

Stable under ordinary conditions of use and storage.

**Hazardous Decomposition Products:**

Carbon dioxide and carbon monoxide may form when heated to decomposition.

**Hazardous Polymerization:**

Will not occur.

**Incompatibilities:**

Contact with strong oxidizing agents may cause fires and explosions. Attacks many plastics.

**Conditions to Avoid:**

Heat, flames, ignition sources and incompatibles.

---

## 11. Toxicological Information

For Ethyl Benzene - Oral rat LD50: 3500 mg/Kg; Skin rabbit LD50:15430 mg/Kg.  
Investigated as a tumorigen, mutagen, reproductive effector.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Ethyl Benzene (100-41-4)	No	No	2B

## 12. Ecological Information

### Environmental Fate:

When released into water, this material is expected to readily biodegrade. When released to water, this material is expected to quickly evaporate. This material is not expected to significantly bioaccumulate. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is not expected to be degraded by photolysis.

### Environmental Toxicity:

96 Hr LC50 bluegill:150.0 mg/L (Static);

96 Hr LC50 fathead minnow :9.09 mg/L, (flow-through);

96 Hr LC50 rainbow trout: 14.0 mg/L (Static).

## 13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

## 14. Transport Information

### Domestic (Land, D.O.T.)

-----  
**Proper Shipping Name:** ETHYLBENZENE

**Hazard Class:** 3

**UN/NA:** UN1175

**Packing Group:** II

**Information reported for product/size: 52L****International (Water, I.M.O.)****Proper Shipping Name:** ETHYLBENZENE**Hazard Class:** 3**UN/NA:** UN1175**Packing Group:** II**Information reported for product/size: 52L****International (Air, I.C.A.O.)****Proper Shipping Name:** ETHYLBENZENE**Hazard Class:** 3**UN/NA:** UN1175**Packing Group:** II**Information reported for product/size: 52L**

## 15. Regulatory Information

```

-----\Chemical Inventory Status - Part 1\-----
Ingredient                                     TSCA   EC     Japan  Australia
-----
Ethyl Benzene (100-41-4)                     Yes   Yes   Yes    Yes

```

```

-----\Chemical Inventory Status - Part 2\-----
Ingredient                                     Korea  DSL    NDSL   Phil.
-----
Ethyl Benzene (100-41-4)                     Yes   Yes   No     Yes

```

```

-----\Federal, State & International Regulations - Part 1\-----
Ingredient                                     -SARA 302-   -SARA 313-
RQ      TPQ      List  Chemical Catg.
-----
Ethyl Benzene (100-41-4)                     No    No     Yes    No

```

```

-----\Federal, State & International Regulations - Part 2\-----
Ingredient                                     -RCRA-      -TSCA-
CERCLA   261.33   8(d)
-----
Ethyl Benzene (100-41-4)                     1000       No        No

```

Chemical Weapons Convention: No      TSCA 12(b): No      CDTA: No  
 SARA 311/312: Acute: Yes      Chronic: Yes      Fire: Yes      Pressure: No  
 Reactivity: No      (Pure / Liquid)

**WARNING:**

**THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.**

**Australian Hazchem Code:** 3[Y]E

**Poison Schedule:** None allocated.

**WHMIS:**

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

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## 16. Other Information

**NFPA Ratings:** Health: **2** Flammability: **3** Reactivity: **0**

**Label Hazard Warning:**

WARNING! FLAMMABLE LIQUID AND VAPOR. HARMFUL IF SWALLOWED OR INHALED. VAPOR OR MIST IS IRRITATING TO THE EYES AND UPPER RESPIRATORY TRACT. CAUSES SKIN IRRITATION. AFFECTS CENTRAL NERVOUS SYSTEM.

**Label Precautions:**

Keep away from heat, sparks and flame.

Keep container closed.

Use only with adequate ventilation.

Avoid contact with eyes, skin and clothing.

Avoid breathing vapor or mist.

Wash thoroughly after handling.

**Label First Aid:**

If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.

**Product Use:**

Laboratory Reagent.

**Revision Information:**

MSDS Section(s) changed since last revision of document include: 3, 11, 12.

**Disclaimer:**

\*\*\*\*\*

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\*\*\*\*\*

**Prepared by:** Environmental Health & Safety  
Phone Number: (314) 654-1600 (U.S.A.)

# Material Safety Data Sheet

## Naphthalene

ACC# 16120

### Section 1 - Chemical Product and Company Identification

**MSDS Name:** Naphthalene**Catalog Numbers:** AC164210000, AC164210010, AC164210025, AC180200000, AC180200010, AC180200050, AC180202500, AC180900000, AC180900010, AC180902500, S76307, S763071, N134-500, N7-500**Synonyms:** Coal tar camphor; Tar camphor; Naphthalin; White tar; Naphthene; Moth flakes; Moth balls.**Company Identification:**Fisher Scientific  
1 Reagent Lane  
Fair Lawn, NJ 07410**For information, call:** 201-796-7100**Emergency Number:** 201-796-7100**For CHEMTREC assistance, call:** 800-424-9300**For International CHEMTREC assistance, call:** 703-527-3887

### Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
91-20-3	Naphthalene	>98	202-049-5

**Hazard Symbols:** XN N**Risk Phrases:** 22

### Section 3 - Hazards Identification

#### EMERGENCY OVERVIEW

Appearance: white solid. Flash Point: 78 deg C. **Warning!** May cause blood abnormalities. Hygroscopic (absorbs moisture from the air). Flammable solid. May be harmful if absorbed through the skin. Harmful if inhaled or swallowed. Causes eye, skin, and respiratory tract irritation.

**Target Organs:** Blood, respiratory system, eyes, skin.

#### Potential Health Effects

**Eye:** Naphthalene is an eye irritant. The vapor causes eye irritation at 15 ppm. Eye contact with the solid material may result in conjunctivitis, superficial injury to the cornea, diminished visual acuity, and other effects. It may cause cataracts.

**Skin:** Causes mild skin irritation. May be absorbed through the skin in harmful amounts. Incidence of skin hypersensitivity is not widespread in the general population &, based on the long history of use of naphthalene as a consumer product, this effect is mostly confined to industrial exposure where coal tar contamination may be present.

**Ingestion:** Harmful if swallowed. May cause liver and kidney damage. May cause methemoglobinemia, cyanosis (bluish discoloration of skin due to deficient oxygenation of the blood), convulsions, and death. May cause severe digestive tract irritation with abdominal pain, nausea, vomiting and diarrhea. Ingestion of large quantities may cause severe hemolytic anemia and hemoglobinuria.

**Inhalation:** Harmful if inhaled. Causes respiratory tract irritation. Readily absorbed when inhaled. Material volatilizes at room temperature. Hemolytic anemia (destruction of red blood cells) is the primary health concern for humans exposed to naphthalene for either short or long periods of time. Other effects may include nausea, profuse perspiration, vomiting, kidney damage and liver damage. Optic neuritis (inflammation of the optic nerve) has been observed. Cataracts have also occurred.

**Chronic:** Prolonged or repeated skin contact may cause dermatitis. May cause liver and kidney damage. May cause anemia and other blood cell abnormalities. Animal studies have reported that fetal effects/abnormalities may occur when maternal toxicity is seen. Effects may be delayed. Chronic exposure may cause lung damage. Laboratory experiments have resulted in mutagenic effects. Chronic exposure may cause corneal injury, optical neuritis, blurred vision, and possible cataract formation. Chronic inhalation, skin absorption or ingestion of naphthalene have caused severe hemolytic anemia.

## Section 4 - First Aid Measures

**Eyes:** In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical aid.  
**Skin:** In case of contact, flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical aid if irritation develops and persists. Wash clothing before reuse.  
**Ingestion:** If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical aid.  
**Inhalation:** If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.  
**Notes to Physician:** Individuals with a glucose-6-phosphate dehydrogenase deficiency are hypersensitive to the effects of naphthalene.

## Section 5 - Fire Fighting Measures

**General Information:** As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Water runoff can cause environmental damage. Dike and collect water used to fight fire. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Use water spray to keep fire-exposed containers cool. Flammable solid. Dusts may be an explosion hazard if mixed with air at critical proportions and in the presence of an ignition source. Volatile solid that gives off flammable vapors when heated.  
**Extinguishing Media:** Water or foam may cause frothing. Use water spray, dry chemical, carbon dioxide, or appropriate foam.  
**Flash Point:** 78 deg C ( 172.40 deg F)  
**Autoignition Temperature:** 526 deg C ( 978.80 deg F)  
**Explosion Limits, Lower:** 0.90 vol %  
**Upper:** 5.90 vol %  
**NFPA Rating:** (estimated) Health: 2; Flammability: 2; Instability: 0

## Section 6 - Accidental Release Measures

**General Information:** Use proper personal protective equipment as indicated in Section 8.  
**Spills/Leaks:** Avoid runoff into storm sewers and ditches which lead to waterways. Clean up spills immediately, observing precautions in the Protective Equipment section. Scoop up with a nonsparking tool, then place into a suitable container for disposal. Avoid generating dusty conditions. Remove all sources of ignition. Provide ventilation. Do not let this chemical enter the environment.

## Section 7 - Handling and Storage

**Handling:** Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Minimize dust generation and accumulation. Avoid breathing dust, vapor, mist, or gas. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Use only with adequate ventilation.  
**Storage:** Keep away from sources of ignition. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances. Storage under a nitrogen blanket has been recommended. Store protected from moisture. Separate from oxidizing materials.

## Section 8 - Exposure Controls, Personal Protection

**Engineering Controls:** Use explosion-proof ventilation equipment. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

**Exposure Limits**

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Naphthalene	10 ppm TWA; 15 ppm STEL; skin - potential for cutaneous absorption	10 ppm TWA; 50 mg/m <sup>3</sup> TWA 250 ppm IDLH	10 ppm TWA; 50 mg/m <sup>3</sup> TWA

**OSHA Vacated PELs:** Naphthalene: 10 ppm TWA; 50 mg/m<sup>3</sup> TWA

**Personal Protective Equipment**

**Eyes:** Wear chemical goggles.

**Skin:** Wear appropriate protective gloves to prevent skin exposure.

**Clothing:** Wear appropriate protective clothing to prevent skin exposure.

**Respirators:** A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

## Section 9 - Physical and Chemical Properties

**Physical State:** Solid

**Appearance:** white

**Odor:** Distinctive mothball-like.

**pH:** Not available.

**Vapor Pressure:** 0.05 mm Hg @ 20 deg C

**Vapor Density:** 4.4 (air=1)

**Evaporation Rate:** <1.0 (butyl acetate=1)

**Viscosity:** Not available.

**Boiling Point:** 218 deg C

**Freezing/Melting Point:** 79 - 82 deg C

**Decomposition Temperature:** 540 deg C

**Solubility:** Insoluble.

**Specific Gravity/Density:** 0.9900g/cm<sup>3</sup>

**Molecular Formula:** C<sub>10</sub>H<sub>8</sub>

**Molecular Weight:** 128.17

## Section 10 - Stability and Reactivity

**Chemical Stability:** Stable at room temperature in closed containers under normal storage and handling conditions.

**Conditions to Avoid:** Ignition sources, dust generation, moisture, excess heat, exposure to moist air or water, steam.

**Incompatibilities with Other Materials:** Strong oxidizing agents.

**Hazardous Decomposition Products:** Carbon monoxide, irritating and toxic fumes and gases, carbon dioxide.

**Hazardous Polymerization:** Will not occur.

## Section 11 - Toxicological Information

**RTECS#:**

**CAS#** 91-20-3: QJ0525000

**LD50/LC50:**

CAS# 91-20-3:

Draize test, rabbit, eye: 100 mg Mild;

Inhalation, rat: LC50 = >340 mg/m<sup>3</sup>/1H;

Oral, mouse: LD50 = 316 mg/kg;

Oral, rat: LD50 = 490 mg/kg;

Skin, rabbit: LD50 = >20 gm/kg;

Skin, rat: LD50 = >2500 mg/kg;

**Carcinogenicity:**

CAS# 91-20-3:

**California:** carcinogen, initial date 4/19/02

**IARC:** Group 2B carcinogen

**Epidemiology:** Incidents in which blankets or clothing containing naphthalene caused acute hemolysis in infants, in some cases fatal, have been described. The percutaneous absorption and systemic intoxication with naphthalene can be facilitated by oily vehicles.

**Teratogenicity:** Naphthalene and its metabolites have been reported to cross the human placenta in amounts sufficient to cause fetal toxicity. Oral, rat: TDLo = 4500 mg/kg (female 6-15 day(s) after conception) Effects on Embryo or Fetus - fetotoxicity (except death, e.g., stunted fetus) and Specific Developmental Abnormalities - other developmental abnormalities.; Intraperitoneal, rat: TDLo = 5925 mg/kg (female 1-15 day(s) after conception) Specific Developmental Abnormalities - musculoskeletal system and cardiovascular (circulatory) system.

**Reproductive Effects:** No information available.

**Neurotoxicity:** No information available.

**Mutagenicity:** Micronucleus Test: Human, Lymphocyte = 30 mg/L.; Cytogenetic Analysis: Hamster, Ovary = 30 mg/L.; Sister Chromatid Exchange: Hamster, Ovary = 15 mg/L.

**Other Studies:** Standard Draize Test: Administration onto the skin (rabbit) = 495 mg (Mild).; Standard Draize Test: Administration into the eye (rabbit) = 100 mg (Mild).

## Section 12 - Ecological Information

**Ecotoxicity:** Fish: Rainbow trout: LC50 = 1.60 mg/L; 96 Hr; Flow-through at 15 CFish: Fathead Minnow: LC50 = 6.14 mg/L; 96 Hr; Flow-through at 24.5 CWater flea Daphnia: EC50 = 2.16-8.60 mg/L; 48 Hr; Unspecified Bacteria: Phytobacterium phosphoreum: EC50 = 0.93 mg/L; 30 min; Microtox testFish: Pink salmon: LC50 = 1.24 mg/L; 96 Hr; (fry) Static bioassay at 12°C Releases into water are lost due to volatilization, photolysis, adsorption, and biodegradation. The principal loss processes will depend on local conditions but half-lives can be expected to range from a couple of days to a few months. When adsorbed to sediment, biodegradation occurs much more rapidly than in the overlying water column. When spilled on land, naphthalene is adsorbed moderately to soil and undergoes biodegradation. However, in some cases it will appear in the groundwater where biodegradation still may occur if conditions are aerobic.

**Environmental:** Bioconcentration occurs to a moderate extent but since depuration and metabolism readily proceed in aquatic organisms, this is a short term problem. transport and disposal of fuel oil, coal tar, etc. In the atmosphere, naphthalene rapidly photodegrades (half-life 3-8 hr). Naphthalene shows low biological oxygen demand and is expected to cause little O<sub>2</sub> depletion in aquatic systems.

**Physical:** Log P (oct) = 3.01 - 3.59

**Other:** Harmful to aquatic life in very low concentrations.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

**RCRA P-Series:** None listed.

**RCRA U-Series:** CAS# 91-20-3: waste number U165.

## Section 14 - Transport Information

	US DOT	IATA	RID/ADR	IMO	Canada TDG
<b>Shipping Name:</b>	NAPHTHALENE, CRUDE				NAPHTHALENE
<b>Hazard Class:</b>	4.1				4.1
<b>UN Number:</b>	UN1334				UN1334
<b>Packing Group:</b>	III				III

## Section 15 - Regulatory Information

### US FEDERAL

#### TSCA

CAS# 91-20-3 is listed on the TSCA inventory.

#### Health & Safety Reporting List

CAS# 91-20-3: Effective 6/1/87; Sunset 6/1/97

#### Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

#### Section 12b

None of the chemicals are listed under TSCA Section 12b.

#### TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

#### SARA

#### CERCLA Hazardous Substances and corresponding RQs

CAS# 91-20-3: 100 lb final RQ; 45.4 kg final RQ

#### SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

#### SARA Codes

CAS # 91-20-3: acute, chronic, flammable.

#### Section 313

This material contains Naphthalene (CAS# 91-20-3, 98%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

#### Clean Air Act:

CAS# 91-20-3 is listed as a hazardous air pollutant (HAP). This material does not contain any Class 1 Ozone depleters. This material does not contain any Class 2 Ozone depleters.

#### Clean Water Act:

CAS# 91-20-3 is listed as a Hazardous Substance under the CWA. CAS# 91-20-3 is listed as a Priority Pollutant under the Clean Water Act. CAS# 91-20-3 is listed as a Toxic Pollutant under the Clean Water Act.

#### OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

#### STATE

CAS# 91-20-3 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

**The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:** WARNING: This product contains Naphthalene, a chemical known to the state of California to cause cancer. California No Significant Risk Level: None of the chemicals in this product are listed.

### European/International Regulations

#### European Labeling in Accordance with EC Directives

#### Hazard Symbols:

XN N

#### Risk Phrases:

R 22 Harmful if swallowed.

R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

#### Safety Phrases:

S 36/37 Wear suitable protective clothing and gloves.  
S 60 This material and its container must be disposed of as hazardous waste.  
S 61 Avoid release to the environment. Refer to special instructions/safety data sheets.

**WGK (Water Danger/Protection)**

CAS# 91-20-3: 2

**Canada - DSL/NDSL**

CAS# 91-20-3 is listed on Canada's DSL List.

**Canada - WHMIS**

This product does not have a WHMIS classification.

**Canadian Ingredient Disclosure List**

CAS# 91-20-3 is listed on the Canadian Ingredient Disclosure List.

**Exposure Limits**

CAS# 91-20-3: OEL-ARAB Republic of Egypt:TWA 10 ppm (50 mg/m3) OEL-AUSTRALIA:TWA 10 ppm (50 mg/m3);STEL 15 ppm (75 mg/m3) OEL-BELGIUM:TW A 10 ppm (52 mg/m3);STEL 15 ppm (79 mg/m3) OEL-DENMARK:TWA 10 ppm (50 mg/m3) OEL-FINLAND:TWA 10 ppm (50 mg/m3);STEL 20 ppm (10 mg/m3) OEL -FRANCE:TWA 10 ppm (50 mg/m3) OEL-GERMANY:TWA 10 ppm (50 mg/m3) OEL-HUNGARY:TWA 40 mg/m3;STEL 80 mg/m3;Skin OEL-THE NETHERLANDS:TWA 10 pp m (50 mg/m3) OEL-THE PHILIPPINES:TWA 10 ppm (50 mg/m3) OEL-POLAND:TW A 20 mg/m3 OEL-RUSSIA:STEL 20 mg/m3 OEL-SWITZERLAND:TWA 10 ppm (50 m g/m3) OEL-UNITED KINGDOM:TWA 10 ppm (50 mg/m3);STEL 15 ppm (75 mg/m3) OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV

<b>Section 16 - Additional Information</b>
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**MSDS Creation Date:** 5/14/1999

**Revision #6 Date:** 2/06/2004

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MSDS Number: **T3913** \* \* \* \* \* *Effective Date: 10/05/06* \* \* \* \* \* *Supersedes: 08/03/04*



## Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.  
222 Red School Lane  
Phillipsburg, NJ 08865



Mallinckrodt  
CHEMICALS



24 Hour Emergency Telephone: 908-859-2151  
CHEMTREC: 1-800-424-9300

National Response in Canada  
CANUTEC: 613-996-6666

Outside U.S. and Canada  
Chemtec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

# TOLUENE

## 1. Product Identification

**Synonyms:** Methylbenzene; Toluol; Phenylmethane

**CAS No.:** 108-88-3

**Molecular Weight:** 92.14

**Chemical Formula:** C<sub>6</sub>H<sub>5</sub>-CH<sub>3</sub>

**Product Codes:**

J.T. Baker: 5375, 5812, 9336, 9351, 9364, 9456, 9457, 9459, 9460, 9462, 9466, 9472, 9476

Mallinckrodt: 4483, 8092, 8604, 8608, 8610, 8611, V560

## 2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Toluene	108-88-3	100%	Yes

## 3. Hazards Identification

### Emergency Overview



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**POISON! DANGER! HARMFUL OR FATAL IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. VAPOR HARMFUL. FLAMMABLE LIQUID AND VAPOR. MAY AFFECT LIVER, KIDNEYS, BLOOD SYSTEM, OR CENTRAL NERVOUS SYSTEM. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.**

**SAF-T-DATA<sup>(tm)</sup>** Ratings (Provided here for your convenience)  
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Health Rating: 2 - Moderate (Life)

Flammability Rating: 3 - Severe (Flammable)

Reactivity Rating: 1 - Slight

Contact Rating: 3 - Severe (Life)

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER

Storage Color Code: Red (Flammable)  
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### **Potential Health Effects**

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#### **Inhalation:**

Inhalation may cause irritation of the upper respiratory tract. Symptoms of overexposure may include fatigue, confusion, headache, dizziness and drowsiness. Peculiar skin sensations (e. g. pins and needles) or numbness may be produced. Very high concentrations may cause unconsciousness and death.

#### **Ingestion:**

Swallowing may cause abdominal spasms and other symptoms that parallel overexposure from inhalation. Aspiration of material into the lungs can cause chemical pneumonitis, which may be fatal.

#### **Skin Contact:**

Causes irritation. May be absorbed through skin.

#### **Eye Contact:**

Causes severe eye irritation with redness and pain.

#### **Chronic Exposure:**

Reports of chronic poisoning describe anemia, decreased blood cell count and bone marrow hypoplasia. Liver and kidney damage may occur. Repeated or prolonged contact has a defatting action, causing drying, redness, dermatitis. Exposure to toluene may affect the developing fetus.

#### **Aggravation of Pre-existing Conditions:**

Persons with pre-existing skin disorders or impaired liver or kidney function may be more susceptible to the effects of this substance. Alcoholic beverage consumption can enhance the toxic effects of this substance.

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## **4. First Aid Measures**

#### **Inhalation:**

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing

is difficult, give oxygen. CALL A PHYSICIAN IMMEDIATELY.

**Ingestion:**

Aspiration hazard. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately. If vomiting occurs, keep head below hips to prevent aspiration into lungs.

**Skin Contact:**

In case of contact, immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Call a physician immediately.

**Eye Contact:**

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

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## 5. Fire Fighting Measures

**Fire:**

Flash point: 7C (45F) CC

Autoignition temperature: 422C (792F)

Flammable limits in air % by volume:

lcl: 1.1; ucl: 7.1

Flammable liquid and vapor!

Dangerous fire hazard when exposed to heat or flame. Vapors can flow along surfaces to distant ignition source and flash back.

**Explosion:**

Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Contact with strong oxidizers may cause fire or explosion. Sensitive to static discharge.

**Fire Extinguishing Media:**

Dry chemical, foam or carbon dioxide. Water may be used to flush spills away from exposures and to dilute spills to non-flammable mixtures.

**Special Information:**

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Water spray may be used to keep fire exposed containers cool.

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## 6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials,

such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker SOLUSORB® solvent adsorbent is recommended for spills of this product.

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## 7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

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## 8. Exposure Controls/Personal Protection

### **Airborne Exposure Limits:**

Toluene:

- OSHA Permissible Exposure Limit (PEL):

200 ppm (TWA); 300 ppm (acceptable ceiling conc.); 500 ppm (maximum conc.).

- ACGIH Threshold Limit Value (TLV):

50 ppm (TWA) skin, A4 - Not Classifiable as a Human Carcinogen.

### **Ventilation System:**

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

### **Personal Respirators (NIOSH Approved):**

If the exposure limit is exceeded and engineering controls are not feasible, a half-face organic vapor respirator may be worn for up to ten times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece organic vapor respirator may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. **WARNING: Air-**

purifying respirators do not protect workers in oxygen-deficient atmospheres.

**Skin Protection:**

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

**Eye Protection:**

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

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## 9. Physical and Chemical Properties

**Appearance:**

Clear, colorless liquid.

**Odor:**

Aromatic benzene-like.

**Solubility:**

0.05 gm/100gm water @ 20C (68F).

**Specific Gravity:**

0.86 @ 20C / 4 C

**pH:**

No information found.

**% Volatiles by volume @ 21C (70F):**

100

**Boiling Point:**

111C (232F)

**Melting Point:**

-95C (-139F)

**Vapor Density (Air=1):**

3.14

**Vapor Pressure (mm Hg):**

22 @ 20C (68F)

**Evaporation Rate (BuAc=1):**

2.24

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## 10. Stability and Reactivity

**Stability:**

Stable under ordinary conditions of use and storage. Containers may burst when heated.

**Hazardous Decomposition Products:**

Carbon dioxide and carbon monoxide may form when heated to decomposition.

**Hazardous Polymerization:**

Will not occur.

**Incompatibilities:**

Heat, flame, strong oxidizers, nitric and sulfuric acids, chlorine, nitrogen tetroxide; will attack some forms of plastics, rubber, coatings.

**Conditions to Avoid:**

Heat, flames, ignition sources and incompatibles.

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## 11. Toxicological Information

**Toxicological Data:**

Oral rat LD50: 636 mg/kg; skin rabbit LD50: 14100 uL/kg; inhalation rat LC50: 49 gm/m<sup>3</sup>/4H; Irritation data: skin rabbit, 500 mg, Moderate; eye rabbit, 2 mg/24H, Severe. Investigated as a tumorigen, mutagen, reproductive effector.

**Reproductive Toxicity:**

Has shown some evidence of reproductive effects in laboratory animals.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
-----			
Toluene (108-88-3)	No	No	3

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## 12. Ecological Information

**Environmental Fate:**

When released into the soil, this material may evaporate to a moderate extent.  
When released into the soil, this material is expected to leach into groundwater.  
When released into the soil, this material may biodegrade to a moderate extent.  
When released into water, this material may evaporate to a moderate extent. When released into water, this material may biodegrade to a moderate extent. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life of less than 1 day. This material is not expected to significantly bioaccumulate. This material has a log octanol-water partition coefficient of less than 3.0. Bioconcentration factor = 13.2 (eels).

**Environmental Toxicity:**

This material is expected to be toxic to aquatic life. The LC50/96-hour values for fish are between 10 and 100 mg/l.

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## 13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

## 14. Transport Information

### Domestic (Land, D.O.T.)

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**Proper Shipping Name:** TOLUENE

**Hazard Class:** 3

**UN/NA:** UN1294

**Packing Group:** II

**Information reported for product/size:** 390LB

### International (Water, I.M.O.)

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**Proper Shipping Name:** TOLUENE

**Hazard Class:** 3

**UN/NA:** UN1294

**Packing Group:** II

**Information reported for product/size:** 390LB

## 15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----				
Ingredient	TSCA	EC	Japan	Australia
Toluene (108-88-3)	Yes	Yes	Yes	Yes

-----\Chemical Inventory Status - Part 2\-----				
Ingredient	Korea	DSL	--Canada-- NDSL	Phil.
Toluene (108-88-3)	Yes	Yes	No	Yes

-----\Federal, State & International Regulations - Part 1\-----				
Ingredient	-SARA 302- RQ	TPQ	-----SARA 313----- List	Chemical Catg.
Toluene (108-88-3)	No	No	Yes	No

-----\Federal, State & International Regulations - Part 2\-----			
Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Toluene (108-88-3)	1000	U220	No

Chemical Weapons Convention: No      TSCA 12(b): No      CDTA: Yes  
 SARA 311/312: Acute: Yes      Chronic: Yes      Fire: Yes      Pressure: No  
 Reactivity: No      (Pure / Liquid)

### WARNING:

THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF

CALIFORNIA TO CAUSE BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

**Australian Hazchem Code:** 3[Y]E

**Poison Schedule:** S6

**WHMIS:**

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

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## 16. Other Information

**NFPA Ratings:** Health: **2** Flammability: **3** Reactivity: **0**

**Label Hazard Warning:**

POISON! DANGER! HARMFUL OR FATAL IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. VAPOR HARMFUL. FLAMMABLE LIQUID AND VAPOR. MAY AFFECT LIVER, KIDNEYS, BLOOD SYSTEM, OR CENTRAL NERVOUS SYSTEM. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.

**Label Precautions:**

Keep away from heat, sparks and flame.

Keep container closed.

Use only with adequate ventilation.

Wash thoroughly after handling.

Avoid breathing vapor.

Avoid contact with eyes, skin and clothing.

**Label First Aid:**

Aspiration hazard. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If vomiting occurs, keep head below hips to prevent aspiration into lungs. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician immediately.

**Product Use:**

Laboratory Reagent.

**Revision Information:**

MSDS Section(s) changed since last revision of document include: 5.

**Disclaimer:**

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**Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR**

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\*\*\*\*\*

**Prepared by:** Environmental Health & Safety  
Phone Number: (314) 654-1600 (U.S.A.)



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MSDS Number: **X2000** \* \* \* \* \* *Effective Date: 02/16/06* \* \* \* \* \* *Supersedes: 04/01/03*

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**MSDS****Material Safety Data Sheet**

From: Mallinckrodt Baker, Inc.  
222 Red School Lane  
Phillipsburg, NJ 08865



Mallinckrodt  
CHEMICALS



24 Hour Emergency Telephone: 908-859-2151  
CHEMTREC: 1-800-424-9300

National Response in Canada  
CANUTEC: 613-996-6666

Outside U.S. and Canada  
Chemtec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

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# XYLENES

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## 1. Product Identification

**Synonyms:** Dimethyl benzene, xylol, methyltoluene

**CAS No.:** 1330-20-7

**Molecular Weight:** 106.17

**Chemical Formula:** C<sub>6</sub>H<sub>4</sub>(CH<sub>3</sub>)<sub>2</sub>

**Product Codes:**

J.T. Baker: 5377, 5813, 9483, 9489, 9490, 9493, 9494, 9499, 9516, X516

Mallinckrodt: 8664, 8668, 8671, 8672, 8802, V052

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## 2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
-----	-----	-----	-----
m-Xylene	108-38-3	40 - 65%	Yes
o-Xylene	95-47-6	15 - 20%	Yes
p-Xylene	106-42-3	< 20%	Yes
Ethyl Benzene	100-41-4	15 - 25%	Yes

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## 3. Hazards Identification

## Emergency Overview

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**DANGER! HARMFUL OR FATAL IF SWALLOWED. VAPOR HARMFUL. AFFECTS CENTRAL NERVOUS SYSTEM. CAUSES SEVERE EYE IRRITATION. CAUSES IRRITATION TO SKIN AND RESPIRATORY TRACT. MAY BE HARMFUL IF ABSORBED THROUGH SKIN. CHRONIC EXPOSURE CAN CAUSE ADVERSE LIVER, KIDNEY, AND BLOOD EFFECTS. FLAMMABLE LIQUID AND VAPOR.**

## SAF-T-DATA<sup>(tm)</sup> Ratings (Provided here for your convenience)

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Health Rating: 2 - Moderate (Life)

Flammability Rating: 2 - Moderate

Reactivity Rating: 1 - Slight

Contact Rating: 3 - Severe

Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES;  
CLASS B EXTINGUISHER

Storage Color Code: Red (Flammable)

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## Potential Health Effects

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### Inhalation:

Inhalation of vapors may be irritating to the nose and throat. Inhalation of high concentrations may result in nausea, vomiting, headache, ringing in the ears, and severe breathing difficulties which may be delayed in onset. Substernal pain, cough, and hoarseness are also reported. High vapor concentrations are anesthetic and central nervous system depressants.

### Ingestion:

Ingestion causes burning sensation in mouth and stomach, nausea, vomiting and salivation. Minute amounts aspirated into the lungs can produce a severe hemorrhagic pneumonitis with severe pulmonary injury or death.

### Skin Contact:

Skin contact results in loss of natural oils and often results in a characteristic dermatitis. May be absorbed through the skin.

### Eye Contact:

Vapors cause eye irritation. Splashes cause severe irritation, possible corneal burns and eye damage.

### Chronic Exposure:

Chronic inhalation can cause headache, loss of appetite, nervousness and pale skin. Repeated or prolonged skin contact may cause a skin rash. Repeated exposure of the eyes to high concentrations of vapor may cause reversible eye damage. Repeated exposure can damage bone marrow, causing low blood cell count. May damage the liver and kidneys.

### Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders or eye problems, or impaired liver, kidney, blood, or respiratory function may be more susceptible to the effects of the substance.

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## 4. First Aid Measures

**Inhalation:**

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician immediately.

**Ingestion:**

Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately.

**Skin Contact:**

Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.

**Eye Contact:**

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

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## 5. Fire Fighting Measures

**Fire:**

Flash point: 29C (84F) CC

Autoignition temperature: 464C (867F)

Flammable limits in air % by volume:

lcl: 1.0; ucl: 7.0

**Explosion:**

Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Contact with strong oxidizers may cause fire. Sealed containers may rupture when heated. Sensitive to static discharge.

**Fire Extinguishing Media:**

Dry chemical, foam or carbon dioxide. Water spray may be used to keep fire exposed containers cool, dilute spills to nonflammable mixtures, protect personnel attempting to stop leak and disperse vapors.

**Special Information:**

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Vapors can flow along surfaces to distant ignition source and flash back.

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## 6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep

unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker SOLUSORB® solvent adsorbent is recommended for spills of this product.

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## 7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product. Do Not attempt to clean empty containers since residue is difficult to remove. Do not pressurize, cut, weld, braze, solder, drill, grind or expose such containers to heat, sparks, flame, static electricity or other sources of ignition: they may explode and cause injury or death.

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## 8. Exposure Controls/Personal Protection

### **Airborne Exposure Limits:**

-OSHA Permissible Exposure Limit (PEL):

100 ppm (TWA) xylene

100 ppm (TWA) ethylbenzene

-ACGIH Threshold Limit Value (TLV):

xylene: 100 ppm (TWA) 150 ppm (STEL), A4 - Not classifiable as a human carcinogen.

ethyl benzene: 100 ppm (TWA) 125 ppm (STEL), A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans.

### **Ventilation System:**

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*,

most recent edition, for details. Use explosion-proof equipment.

**Personal Respirators (NIOSH Approved):**

If the exposure limit is exceeded and engineering controls are not feasible, a half-face organic vapor respirator may be worn for up to ten times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece organic vapor respirator may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. **WARNING:** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres. Where respirators are required, you must have a written program covering the basic requirements in the OSHA respirator standard. These include training, fit testing, medical approval, cleaning, maintenance, cartridge change schedules, etc. See 29CFR1910.134 for details.

**Skin Protection:**

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

**Eye Protection:**

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

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## 9. Physical and Chemical Properties

The following physical data is for xylene.

**Appearance:**

Clear, colorless liquid.

**Odor:**

Characteristic odor.

**Solubility:**

Insoluble in water.

**Specific Gravity:**

0.86 @ 20C/4C

**pH:**

Not applicable.

**% Volatiles by volume @ 21C (70F):**

100

**Boiling Point:**

137 - 140C (279 - 284F)

**Melting Point:**

-25C (-13F)

**Vapor Density (Air=1):**

3.7

**Vapor Pressure (mm Hg):**

8 @ 20C (68F)

**Evaporation Rate (BuAc=1):**

0.7

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## 10. Stability and Reactivity

**Stability:**

Stable under ordinary conditions of use and storage.

**Hazardous Decomposition Products:**

Involvement in a fire causes formation of carbon monoxide and unidentified organic components.

**Hazardous Polymerization:**

Will not occur.

**Incompatibilities:**

Strong oxidizing agents and strong acids.

**Conditions to Avoid:**

Heat, flames, ignition sources and incompatibles.

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## 11. Toxicological Information

**Toxicological Data:**

Xylene: oral rat LD50: 4300 mg/kg; inhalation rat LC50: 5000 ppm/4H; skin rabbit LD50: > 1700 mg/kg; Irritation eye rabbit: 87 mg mild (Std. Draize); irritation skin rabbit 500 mg/24 moderate (Std. Draize); investigated as a tumorigen, mutagen, reproductive effector.

Ethyl benzene: oral rat LD50: 3500 mg/kg; skin rabbit LD50: 17800 uL/kg; investigated as a tumorigen, mutagen, reproductive effector.

**Reproductive Toxicity:**

May cause teratogenic effects.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
m-Xylene (108-38-3)	No	No	3
o-Xylene (95-47-6)	No	No	3
p-Xylene (106-42-3)	No	No	3
Ethyl Benzene (100-41-4)	No	No	2B

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## 12. Ecological Information

**Environmental Fate:**

Following data for xylene: When released into the soil, this material may evaporate to a moderate extent. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material may biodegrade to a moderate extent. When released into water, this material may evaporate to a moderate extent. When released into water, this material may biodegrade to a moderate extent. When released into the air, this material may be moderately

degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life of less than 1 day. This material is not expected to significantly bioaccumulate. (mixed xylenes: octanol / water partition coefficient 3.1 - 3.2; bioconcentration factor = 1.3, eels)

**Environmental Toxicity:**

For xylene: This material is expected to be slightly toxic to aquatic life. The LC50/96-hour values for fish are between 10 and 100 mg/l.

## 13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

## 14. Transport Information

**Domestic (Land, D.O.T.)**

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**Proper Shipping Name:** RQ, XYLENES

**Hazard Class:** 3

**UN/NA:** UN1307

**Packing Group:** III

**Information reported for product/size:** 398LB

**International (Water, I.M.O.)**

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**Proper Shipping Name:** XYLENES

**Hazard Class:** 3

**UN/NA:** UN1307

**Packing Group:** III

**Information reported for product/size:** 398LB

## 15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----				
Ingredient	TSCA	EC	Japan	Australia
m-Xylene (108-38-3)	Yes	Yes	Yes	Yes
o-Xylene (95-47-6)	Yes	Yes	Yes	Yes
p-Xylene (106-42-3)	Yes	Yes	Yes	Yes
Ethyl Benzene (100-41-4)	Yes	Yes	Yes	Yes

## -----\Chemical Inventory Status - Part 2\-----

Ingredient	--Canada--			
	Korea	DSL	NDSL	Phil.
m-Xylene (108-38-3)	Yes	Yes	No	Yes
o-Xylene (95-47-6)	Yes	Yes	No	Yes
p-Xylene (106-42-3)	Yes	Yes	No	Yes
Ethyl Benzene (100-41-4)	Yes	Yes	No	Yes

## -----\Federal, State &amp; International Regulations - Part 1\-----

Ingredient	-SARA 302-		-----SARA 313-----	
	RQ	TPQ	List	Chemical Catg.
m-Xylene (108-38-3)	No	No	Yes	No
o-Xylene (95-47-6)	No	No	Yes	No
p-Xylene (106-42-3)	No	No	Yes	No
Ethyl Benzene (100-41-4)	No	No	Yes	No

## -----\Federal, State &amp; International Regulations - Part 2\-----

Ingredient	CERCLA	-RCRA-		-TSCA-	
		261.33		8(d)	
m-Xylene (108-38-3)	1000	No		No	
o-Xylene (95-47-6)	1000	No		No	
p-Xylene (106-42-3)	100	No		Yes	
Ethyl Benzene (100-41-4)	1000	No		No	

Chemical Weapons Convention: No      TSCA 12(b): Yes      CDTA: No  
 SARA 311/312: Acute: Yes      Chronic: Yes      Fire: Yes      Pressure: No  
 Reactivity: No      (Mixture / Liquid)

**WARNING:**

THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

**Australian Hazchem Code:** 3[Y]

**Poison Schedule:** None allocated.

**WHMIS:**

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

## 16. Other Information

**NFPA Ratings:** Health: **2** Flammability: **3** Reactivity: **0**

**Label Hazard Warning:**

DANGER! HARMFUL OR FATAL IF SWALLOWED. VAPOR HARMFUL.  
 AFFECTS CENTRAL NERVOUS SYSTEM. CAUSES SEVERE EYE IRRITATION.  
 CAUSES IRRITATION TO SKIN AND RESPIRATORY TRACT. MAY BE  
 HARMFUL IF ABSORBED THROUGH SKIN. CHRONIC EXPOSURE CAN CAUSE  
 ADVERSE LIVER, KIDNEY, AND BLOOD EFFECTS. FLAMMABLE LIQUID AND



VAPOR.

**Label Precautions:**

Keep away from heat, sparks and flame.  
Avoid contact with eyes, skin and clothing.  
Keep container closed.  
Use only with adequate ventilation.  
Avoid breathing vapor.  
Wash thoroughly after handling.

**Label First Aid:**

Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. In all cases get medical attention immediately.

**Product Use:**

Laboratory Reagent.

**Revision Information:**

No Changes.

**Disclaimer:**

\*\*\*\*\*

**Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product.**

**Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose.**

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\*\*\*\*\*

**Prepared by:** Environmental Health & Safety  
Phone Number: (314) 654-1600 (U.S.A.)

## **APPENDIX B**

### **HEALTH AND SAFETY FORMS**

# TRAINING SESSION DOCUMENTATION RECORD

<b>Project Name:</b>	<b>Date:</b>
<b>Project Number:</b>	<b>Time: Start: Stop:</b>
<b>Instructor:</b>	<b>Sheet: 1 of</b>
<b>Material Covered:</b>	

[illegible]

I certify that the personnel above have been trained in the subject(s) listed in "Material Covered" as stated.

---

Instructor Signature

**Key Environmental, Inc.**  
Instructor's Company Affiliation

# SUBCONTRACTOR AFFIDAVIT

I have reviewed the Site Health and Safety Plan for the \_\_\_\_\_ Site and understand the potential health and safety hazards at this operation and the emergency response procedures. I agree to conduct all on-site work in conformity with the requirements of the Health and Safety Plan.

**Project Number:**

Date:

[illegible]

Site Supervisor \_\_\_\_\_

## INCIDENT AND INJURY REPORT

This form must be completed and forwarded to Corporate Health and Safety within 24 hours of any incident/injury.  
For serious injuries, also complete page 2 and forward the entire form to Corporate Health and Safety by the end of the day.

<b>Employer Name:</b>	
Employer Address:	
Employer Phone #	Employers FAX #

EMPLOYEE		
Name:	Soc. Sec. #	
Home Address:		
County:	Zip Code:	
Home Telephone:	Date of Birth:	Age:
Occupation: (Job Title):	Sex: Male <input type="checkbox"/> Female <input type="checkbox"/>	
Department:	Married: Yes <input type="checkbox"/> No <input type="checkbox"/>	
How long employed:	Years	Mo.
		No. Children under 18 yrs.

ACCIDENT/INJURY	
Project Name:	Project Number:
Address of Accident:	
County:	Zip Code:
Was accident on company property: Yes <input type="checkbox"/> No <input type="checkbox"/>	
Date and Time of Injury:	Date Reported:
What was Employee doing when injured? (Be specific – include tools, equipment, materials, or objects involved):	
How did the injury occur? (Describe the event that resulted in injury):	
Body Part injured and nature of injury (Be specific):	
Name of object or substance that directly injured the employee:	

MEDICAL	
First aid given by:	
Date of medical assistance:	Was accident fatal?
Name of medical provider:	
Address of medical provider:	
Diagnosis:	
If hospitalized, name and address of hospital:	
<b>EMPLOYEE'S SIGNATURE:</b>	<b>Date:</b>
<b>PREPARER'S SIGNATURE:</b>	<b>Date:</b>
<b>SUPERVISOR'S SIGNATURE:</b>	<b>Date:</b>
<b>HEALTH &amp; SAFETY SIGNATURE:</b>	<b>Date:</b>

## INCIDENT AND INJURY REPORT

ACCIDENT INVESTIGATION AND FOLLOW-UP	
Provide additional information on what the employee was doing and how the injury occurred:	
Witness names (also addresses and phone numbers if not company personnel):	
What did the employee do or fail to do that caused or contributed to the accident?	
What caused or influenced the unsafe act?	
What condition of tools, equipment or the jobsite caused or contributed to the accident?	
What caused or influenced the unsafe condition?	
What action has been taken or is planned to prevent recurrence?	
Person(s) responsible for completion of the action:	
Target date:	Actual completion date:
Completed by:	

OFFICE USE ONLY	
<b>Case Type:</b> First Aid <input type="checkbox"/> Medical <input type="checkbox"/> Restricted or Job Transfer <input type="checkbox"/> Days Away from Work <input type="checkbox"/>	
<b>OSHA Recordable:</b> Yes <input type="checkbox"/> No <input type="checkbox"/>	
<b>Worker's Comp Claim Filed:</b> Yes <input type="checkbox"/> No <input type="checkbox"/>	Date Filed:
Project Manager:	
Date lost work time began:	
Total days away from work:	
Date of restricted activity or job transfer:	
Total restricted/job transfer workdays:	
Date returned to full duty:	

# REAL-TIME MONITORING INSTRUMENT CALIBRATION LOG

<b>Project Name:</b>		<b>Project Number:</b>	
<b>Location:</b>			
<b>Instrument (s):</b>			
<b>Model Number(s):</b>		<b>Serial Number(s):</b>	
<b>Calibration Gas(es):</b>	<b>Concentration</b>		

DATE	TIME	READING	CALIBRATED BY	COMMENTS

## REAL-TIME MONITORING LOG

Date:		Person performing sampling:						
Project Name:		Signature:						
Project No.:								
Time	Monitoring Location (be specific)	READINGS						COMMENTS (Where was sample taken? e.g., breathing zone or other) and <b>Duration of Monitoring</b>
		O <sub>2</sub> %	LEL %	NH <sub>3</sub> ppm	Dust mg/m <sub>3</sub>	Noise dB	Detect or Tube (spec. tube)	

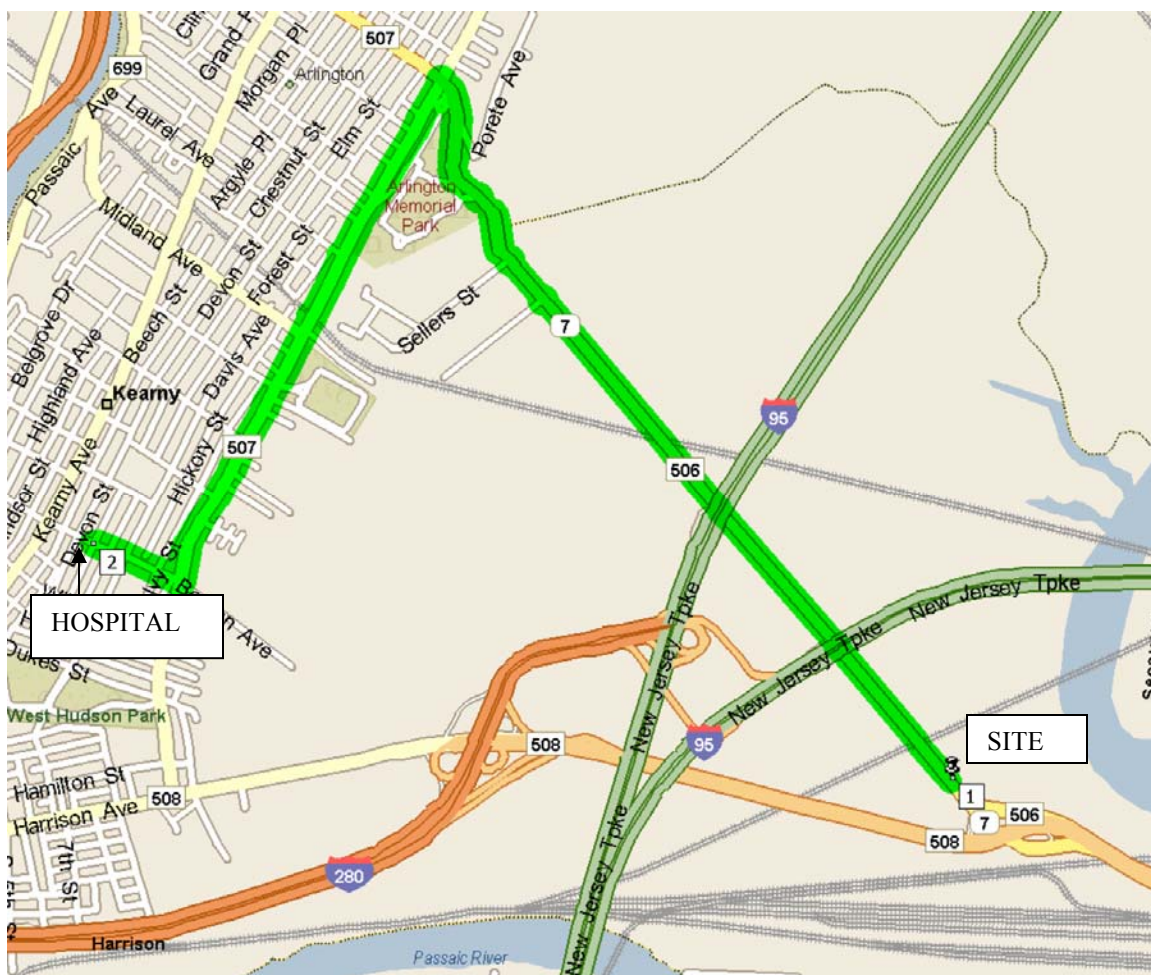
Real Time Instrument Calibration Log should accompany this form.



**APPENDIX C**

**EMERGENCY CONTACTS AND  
HOSPITAL ROUTE MAP**

<b>EMERGENCY NUMBERS</b> <b>Standard Chlorine Chemical Company Site and Diamond Site</b> <b>Kearny, NJ</b>	
Fire	911
Police	911
Ambulance	911
HOSPITAL - West Hudson Hospital 206 Bergen Ave. Kearny, NJ 07032	(201) 955-7040 (emergency)
Poison Control Center	(800) 222-1222
Key Environmental, Inc. - Health & Safety - John Francis	(412) 279-3363 (412) 527-1644 (c)
<b>DIRECTIONS TO EMERGENCY ROOM</b>	
<b>West Hudson Hospital      (201) 995-7000</b> <b>206 Bergen Avenue</b> <b>Kearny, NJ 07322</b>  <b>Turn right onto Belleville Pike and follow west to Schuyler Avenue (near the cemetery),</b> <b>Turn left onto Schuyler Avenue at the cemetery,</b> <b>Follow Schuyler to Bergen Avenue,</b> <b>Turn right onto Bergen Avenue and follow approximately two blocks to the hospital.</b> <b>Approximately 4 miles (10 minutes) to hospital.</b>	
<b>UTILITY NUMBERS</b>	
Call Before You Dig (Garden State Underground Plant Location Service)	800-272-1000
Public Service Electric and Gas	800-436-7734



**West Hudson Hospital      (201) 995-7000**  
**206 Bergen Avenue**  
**Kearny, NJ 07322**

**Turn right onto Belleville Pike and follow west to Schuyler Avenue (near the cemetery),**  
**Turn left onto Schuyler Avenue at the cemetery,**  
**Follow Schuyler to Bergen Avenue,**  
**Turn right onto Bergen Avenue and follow approximately two blocks to the hospital.**  
**Approximately 4 miles (10 minutes) to hospital.**

**APPENDIX D**

**QUALITY ASSURANCE PROJECT PLAN**

**INTERIM RESPONSE ACTION WORKPLAN  
QUALITY ASSURANCE PROJECT PLAN**

**STANDARD CHLORINE CHEMICAL COMPANY SITE  
AND FORMER DIAMOND SITE  
KEARNY, NEW JERSEY**

*Prepared for:*

**The Peninsula Restoration Group**  
(Standard Chlorine Chemical Co., Tierra Solutions, Inc., and Beazer East, Inc.)

*Prepared by:*

**Key Environmental, Inc.**  
200 Third Avenue  
Carnegie, Pennsylvania 15106

**May 2007**

**INTERIM RESPONSE ACTION WORKPLAN  
QUALITY ASSURANCE PROJECT PLAN**

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*Prepared by:*

**Key Environmental, Inc.**  
200 Third Avenue  
Carnegie, Pennsylvania 15106

**May 2007**

---

James. S. Zubrow, P.G.  
Project Manager  
KEY Environmental, Inc.

---

Robert A. Hubbard, P.E.  
Corporate QA Officer  
Key Environmental, Inc.

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- 2 ANALYTICAL SUMMARY

## **LIST OF ATTACHMENTS**

- A KEY STANDARD OPERATING PROCEDURE #155  
GIS/Key Electronic Data Deliverables



## **DISTRIBUTION LIST**

Mr. Christopher J. Kanakis  
NJDEP  
401 East State Street  
CN-028  
Trenton, NJ 08625  
(609) 633-1460

Mr. Frank Franca  
Bureau of Case Management  
NJDEP  
401 East State Street – 5<sup>th</sup> Floor  
P.O. Box 028  
Trenton, NJ 08625  
(609) 984-4071

Mr. Mitchell D. Brouman  
Beazer East, Inc.  
One Oxford Centre, Suite 3000  
Pittsburgh, PA 15219  
(412) 208-8805

Mr. Enrique Castro  
Tierra Solutions, Inc.  
Two Tower Center Blvd, 10<sup>th</sup> Floor  
East Brunswick, NJ 08816  
(732) 246-5852

Ms. Margaret Kelly, Esq.  
Vice President  
Standard Chlorine Chemical Company Inc.  
1035 Belleville Turnpike  
Kearny, NJ 07032-0602

Mr. Gerald M. Coscia  
Langan Engineering Services  
River Drive Center 1  
Elmwood Park, NJ 07407-1338  
(201) 398-4609

Mr. James Zubrow  
KEY Environmental Inc.  
200 Third Avenue  
Carnegie, PA  
(412) 279-3363

## **LIST OF ABBREVIATIONS/ACRONYMS**

%R	Percent recovery
ACOE	Army Corps of Engineers
AOC	Area of Concern
ASTM	American Society for Testing and Materials
Beazer	Beazer East, Inc.
BEMQA	Bureau of Environmental Measurements and Quality Assurance
BTU	British Thermal Units
C	Completeness
CLP	Contract Laboratory Program
COI	Constituents of Interest
COPR	Chromite Ore Processing Residue
DGW	Discharge to Groundwater
DQO	Data Quality Objective
DNAPL	Dense Non-Aqueous Phase Liquid
DO	Dissolved oxygen
EDD	Electronic Data Deliverable
FID	Flame ionization detector
FSP	Field Sampling Plan
FSPM	Field Sampling Procedures Manual
GDMVS	Graphical Data Management and Visualization System
GIS	Geographic Information System
Group	SCCC, Tierra Solutions, Inc., and Beazer East, Inc.
IRA	Interim Response Action
IRAW	Interim Response Action Workplan
KEY	Key Environmental, Inc.
Langan	Langan Engineering Services
LQM	Laboratory Quality Manual
LURP	Land Use Regulatory Program
NJAC	New Jersey Administrative Code
NJ	New Jersey
NJDEP	New Jersey Department of Environmental Protection
NJPDES	New Jersey Pollutant Discharge Elimination System
ORP	Oxidation/Reduction Potential
OVA	Organic Vapor Analyzer
PCBs	Polychlorinated biphenyls
PID	Photo-ionization Detector
Ppm	Parts per million
PVC	Polyvinyl chloride
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RPD	Relative Percent Difference

USDA	United States Department of Agriculture
SAS	Special Analytical Services
SCCC	Standard Chlorine Chemical Co., Inc.
Site	SCCC and former Diamond Sites
SOP	Standard Operating Procedure
SPLP	Synthetic Precipitation Leaching Procedure
SVOC	Semi-Volatile organic compounds
TCLP	Toxicity Characteristic Leaching Procedure
TOX	Total Organic Halogens
Tierra	Tierra Solutions, Inc.
UCSC	Unified Soil Classification System
U.S. EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

## **1.0 PROJECT MANAGEMENT**

On behalf of the Peninsula Restoration Group (Group), Key Environmental, Inc. (KEY) has prepared this Quality Assurance Project Plan (QAPP) to supplement the Interim Response Action Workplan (IRAW) for the Standard Chlorine Chemical Company (SCCC) Site and the adjacent Former Diamond Shamrock (Diamond) Site, located in Kearny, New Jersey. These adjacent sites are hereinafter collectively referred to as the Site.

The IRAW constitutes the primary component of this deliverable. The IRAW describes the interim remedies proposed by the Group for the SCCC and Diamond Sites which consist of the following components:

- barrier wall system;
- hydraulic control and groundwater treatment system;
- dense non-aqueous phase liquid (DNAPL) recovery system;
- lagoon dewatering and backfilling;
- near-shore sediment removal and onsite consolidation and/or offsite treatment/disposal;
- interim surface cover and stormwater management system; and
- various site preparation activities.

Finally, the IRAW provides relevant background information for the Site and defines the field activities required to support the design of the Interim Response Action (IRA) components. This QAPP presents the quality assurance and quality control procedures necessary for execution of the IRA including both field and laboratory analytical methods

The QAPP is complimented by other documents that outline IRA implementation procedures including the Field Sampling Plan (FSP) included as Appendix F of this IRAW, and the Health and Safety Plan (HASP) included as Appendix D of this IRAW. Applicable KEY Standard Operating Procedures (SOPs) are included in Attachment A of this QAPP or in the attendant FSP and are referenced herein where appropriate. If a discrepancy exists between an SOP and specific protocol included in this QAPP, the procedure specified in the main body of the QAPP takes precedence.

This QAPP provides an overview of the analytical methods, data analysis processes, and other procedures to be followed to ensure confidence and to document the validity of the results of the sampling activities described in the IRAW. This QAPP satisfies the New Jersey Department of Environmental Protection's (NJDEP) and the United States Environmental Protection Agency's (U.S. EPA) requirements for a QAPP as outlined in the following guidance:

1. N.J.A.C. 7:26E-2.2, Supp. February 3, 2003;
2. U.S. EPA, "Guidance for the Data Quality Objectives Process," EPA QA/G-4, August 2000; and,

3. U.S. EPA “EPA Requirements for Quality Assurance Project Plans,” EPA QA/R-5, April 2001.

This QAPP has been prepared to serve as the guidance document for quality assurance/quality control (QA/QC) requirements for Site-wide design data acquisition.

## **1.1 PROJECT ORGANIZATION**

The Group will oversee and coordinate the project. KEY will be responsible for ensuring that project-specific sampling activities related to the design data acquisition activities are implemented in conformance with the requirements of the IRAW, FSP, and QAPP. Those tasks not performed by KEY will be completed by subcontractors subject to oversight by KEY. KEY will also provide QA/QC for field activities and deliverables. KEY will issue deliverables to the Group for submittal to the NJDEP, as appropriate.

The management, technical, and QA/QC responsibilities of the project personnel for implementation of the future sampling activities are summarized as follows:

- Group Project Management and Technical Committee [Mssrs. Mitchell Brouman (Beazer), Enrique Castro (Tierra), and Gerry Coscia (Langan on behalf of SCCC)]
  - Coordinate project technical activities
  - Conduct project planning activities
  - Attend review and planning meetings between the Group and NJDEP, as necessary
  - Review all project deliverables
  - Oversee the project budget, schedule, and staffing
- KEY Project Manager (Mr. James Zubrow)
  - Coordinate project technical activities
  - Assist The Group Project Management Committee in project planning
  - Attend review and planning meetings between The Group and NJDEP, as necessary
  - Provide technical guidance to field personnel
  - Establish project files
  - Review all project deliverables
  - Manage the project budget, schedule, and staffing
- KEY Field Investigation Task Leader (Mr. James Snook):
  - Ensure that appropriate field documentation is incorporated into the project files
  - Supervise field investigation activities and ensure that the IRAW and QAPP are followed
  - Provide Health and Safety field support
  - Participate in project meetings with The Group and NJDEP, as necessary
  - Prepare project technical reports

- KEY QA/QC Officer (Mr. Robert Hubbard)
  - Initiate corrective action, as necessary, for quality assurance (QA) compliance
  - Review laboratory data corrective action, as necessary, for QA compliance
  - Coordinate analytical data validation, as required, and review
  - Review laboratory QA/QC
  - Review documentation

Primary responsibility for data quality rests with KEY's QA/QC Officer. Quality assurance will be provided by the analytical laboratory's Project Manager and QA/QC Officer prior to release of data and/or reports to KEY. A data validation specialist, independent of the laboratory, may complete additional data validation review on behalf of the Group contingent upon project-specific Data Quality Objectives (DQOs).

## **1.2 PROBLEM DEFINITION/BACKGROUND**

A detailed description of the Site background information is provided in the IRAW that constitutes the primary portion of this deliverable. Site history information, a Site description, and a description of areas of concern are provided in Section 2.0 IRAW.

## **1.3 PROJECT DESCRIPTION**

Section 4.0 of the IRAW provides a description of the design data acquisitions activities and this description is included herein in its entirety. The design data acquisition activities, identifying the sample collection locations, descriptions, sample matrix, boring depth, sample depth, required analytical suite, sampling method, and intended use of the data are summarized in Table 1. Chemical analytical methods, bottle requirements, quality control samples, preservation, and holding times are summarized in Table 2. The design data acquisition activities will focus on collection of data to support the following interim response action components:

- Barrier Wall System
- Hydraulic Control System
- DNAPL Recovery System
- Lagoon Dewatering and Backfilling
- Near-Shore River Sediment Management
- Interim Surface Cover and Stormwater Management System
- Site Preparation Activities

## **1.4 DATA QUALITY OBJECTIVES**

DQOs specify the appropriate amount and type of data required and tolerable levels of uncertainty for the environmental decisions to be made. U.S. EPA has developed a systematic process for developing DQOs that includes consideration of several critical elements considered during preparation of this QAPP. The process requires definition of the problem and statement of the decisions that will be made based on study results. The users of the data and key personnel

and their roles in the program are identified, as are any regulatory criteria or agencies that will be involved. Information needed to support these decisions can then be determined, including what the contaminants of concern are and physical boundaries of the study area, the quantity of data that will be needed, the means to collect these data and the level of uncertainty that will be acceptable. Program design can then be optimized to collect defensible data in the most efficient manner.

For the purposes of the design data acquisition activities, data will be used to support specific decisions, as follows:

***Barrier Wall System*** – The boring program and subsurface samples will be used to determine the requisite depth of the steel sheet pile and slurry walls such that they can be keyed into a competent geologic unit. Subsurface conditions will also accommodate stability and cost analysis of the use of a deep sheet pile wall versus the use of a shallow wall and tiebacks. In addition, samples will be obtained to support waste classification efforts to accommodate decision-making regarding the disposition of slurry wall trench spoils (i.e., onsite consolidation and/or offsite treatment/disposal).

***Hydraulic Control System*** – The groundwater sampling and analysis program will be conducted to provide the data necessary for design and permitting of the groundwater treatment system. Requisite treatment equipment, vessel sizes, and dosing requirements will be based, in part upon the groundwater sampling and analysis program.

***DNAPL Recovery System*** – The objective of the DNAPL Recovery System investigation is to provide information regarding suitable filter pack and slotted screen for the recovery wells and information to support assessment of DNAPL recoverability as well as disposal options.

***Lagoon Dewatering and Backfilling*** – The lagoon geotechnical and waste classification samples will be obtained to 1) support settlement analysis in association with the dewatering and backfilling option, and 2) to provide contingency classification data for the material in the event that off-site treatment and/or disposal is considered.

***Near-Shore River Sediment Management*** – The near shore Hackensack river sediments will be characterized to facilitate an assessment of onsite consolidation and/or offsite treatment/disposal options. Data acquisition will include 1) collection of physical and chemical data in accordance with a protocol for testing dredged material for use as structural fill (1997 Dredge Manual) as described in the NJDEP LURP WFD/WQC and ACOE permit applications; and, 2) collection of waste classification information to support preparation of a waste classification form and to support determination of onsite versus offsite management options.

***Interim Surface Cover*** – Data to support the design of the interim surface cover will be obtained as a result of other design data acquisition activities, including those to be completed for the barrier wall and those to be obtained as a result of the lagoon dewatering and backfilling investigation efforts.

**Site Preparation Activities** – Sampling and analysis of various materials, consisting of the ditch soft sediments, septic tank contents, transformer pad concrete, and containerized materials will be completed to facilitate preparation of waste classification forms and to support evaluation of onsite consolidation and/or offsite treatment/disposal options.

#### **1.4.1 Project Quality Objectives**

This QAPP serves as a controlling mechanism during the IRA to provide procedures which, when followed properly, will assure that all decisions based on laboratory and field data generated during this investigation are technically sound, statistically valid, and properly documented. Specific procedures for sampling, laboratory analyses, data reporting, and data validation, are presented in other sections of this QAPP.

#### **1.4.2 Measurement Performance Criteria**

The overall QA objective for the IRAW is to provide procedures which, when followed properly, will assure that all decisions based on laboratory and field data generated during this investigation are technically sound, statistically valid, and properly documented. Specific procedures for sample collection, laboratory analyses, data reporting, and data validation, are presented in other sections of this QAPP. The primary purpose of this section is to define statistical acceptance criteria for chemical data generated by the analytical laboratory.

As a result of the varying nature of the data required, there are several applicable levels of data quality for the IRA. A primary component of data quality is selection of the appropriate analytical level for the intended data use. Analytical levels, as described in “Data Quality Objectives for Remedial Response Activities” (U.S. EPA, March 1987), are as follows:

- Level I - Field screening or analysis using portable instruments. Results are often not compound-specific and not quantitative, but are available in real-time. Level I data are appropriate for initial field screening and for health and safety monitoring. They are frequently used to determine sample collection locations for laboratory analyses.
- Level II - Field analysis using more sophisticated portable analytical instruments; in some cases, the instruments may be set up in a mobile laboratory on location. There is a wide range in the quality of data that can be generated that is dependent on the use of suitable calibration standards, reference materials and sample preparation equipment. Results are available in real-time or within several hours.
- Level III - All analyses are performed in an off-site analytical laboratory. Level III provides quantitative data. Documented sampling and analysis procedures must be used. Level III analyses may or may not use Contract Laboratory Program (CLP) procedures, but at a minimum, abbreviated CLP-type deliverables are required. Level III may require data validation and QA/QC procedures conducted in accordance with EPA guidelines. The laboratory may or may not be a CLP laboratory.



- Level IV – CLP-equivalent routine analytical services. All analyses are performed in an off-site analytical laboratory following CLP protocols. Level IV is characterized by rigorous QA/QC protocols and documentation with full validation of all data.
- Level V - Analysis by nonstandard methods. All analyses are performed in an off-site laboratory that may or may not be a CLP laboratory. Method development or method modification may be required for specific constituents or detection limits. CLP Special Analytical Services (SAS) are Level V.

Level I will be used for the field screening activities identified in the IRAW, specifically this includes screening data collected using field instruments such as a photo-ionization detector (PID), flame ionization detector (FID) organic vapor analyzer (OVA), multi-meter, and Horiba™. It is anticipated that all laboratory analytical services for the IRA will be Level III.

Each of these levels is characterized by statistically based criteria expressed in terms of:

- Precision;
- Accuracy;
- Representativeness;
- Completeness;
- Comparability; and,
- Sensitivity.

These parameters are discussed in the following five sections.

#### **1.4.2.1 Precision**

Precision is defined as the degree of agreement between repeated measurements of the same parameter under prescribed, similar conditions. Field and laboratory precision will be monitored using results from duplicate sample analyses. Precision can then be expressed as the relative percent difference (RPD) of one result with another. The RPD is calculated as follows:

$$RPD = \frac{D1 - D2}{\frac{(D1 + D2)}{2}} \times 100$$

Where: RPD = relative percent difference  
D1 = first duplicate value  
D2 = second duplicate value.

The overall DQO for precision of analytical measurements is expressed as a percent of the duplicates having RPDs within established control limits.

The precision of Level I data will be confirmed through repetitive and/or consecutive measurements. The precision of Level III data can be measured through the analysis of field duplicates, laboratory duplicates, and matrix spike duplicates. The frequency of field duplicate collection is specified in Section 2.4.1.1. The frequencies of laboratory duplicate analyses (required for inorganic analyses) and matrix spike/matrix spike duplicate set analyses (required for organic analyses), will be at a minimum of 1 per 20 field samples.

Given anticipated difficulties as a result of matrix interference effects in soils, it is tentatively planned that matrix spike/matrix spike duplicate samples will be spiked at both high and low spike concentrations. The will be conducted to ensure that discernable concentrations of the spiked compounds are measured.

Reproducibility is expressed as a relative percent difference, which is the absolute value of the range between the duplicate results divided by the mean. Acceptable RPDs for each analyte from laboratory and matrix spike duplicates are specified in descriptions of their respective methods. Field duplicate precision criteria for soils and waters are included in data validation guidelines.

#### **1.4.2.2 Accuracy**

Accuracy is the measure of the degree of agreement between an analyzed value and the true or accepted value where it is known. Accuracy will be monitored using known concentrations of analytes and surrogates spiked into blanks and selected samples. Accuracy can then be expressed as a percent recovery (%R), which is calculated as follows:

$$\%R = \frac{Qd}{Qa} \times 100$$

Where: %R = percent recovery  
Qd = spiked sample result minus the sample result  
Qa = spiked amount.

The overall DQO for accuracy is thus the percent of samples that have %R within prescribed control limits.

Accuracy of Level III data can be measured by the analysis of equipment blanks, trip blanks, method blanks, matrix spikes, and surrogate standards. Blanks provide a way of detecting biases introduced in the sampling, sample handling, and analysis. Matrix spikes are samples to which known amounts of target constituents are added.

The frequency of equipment blank and trip blank collection and analysis is specified in Section 2.4.1.1. The frequencies of analyses of method blanks, laboratory control spikes, and matrix spikes, and surrogate standards are specified in the respective methods. The methods also present the acceptable percent recovery limits for each analyte.

### **1.4.2.3 Representativeness**

Representativeness expresses the extent to which the analytical data reflect the actual media at the Site and are representative of Site conditions and characteristics. Representativeness is a function of the sampling program design and execution and the analytical program. Representativeness from field activities is addressed by collecting an adequate number of samples from optimal locations using standard procedures. The number and location of samples and methodologies of sampling is specified in the attendant Field Sampling Plan (Appendix F). Representativeness as a function of analytical-method issues may be compromised by method deviations, the presence of potential laboratory or field artifacts, indications of sample non-homogeneity, and recovery anomalies from surrogates or spikes into field samples.

### **1.4.2.4 Completeness**

Completeness (C) is a measure of the amount of valid data obtained from an analytical measurement system. It is expressed as a percent of the overall data that were generated and is calculated as follows:

$$\%C = \frac{V}{T} \times 100$$

Where:    %C = percent completeness  
             V = number of measurements judged valid  
             T = total number of measurements.

An acceptable percentage of data determined to be valid should be established as target goals for each particular objective. Anything below these goals would require re-sampling and re-analysis or a modification to the goal with justification. As a general rule, the sampling programs will be designed so that program needs will be met if 90% completeness is achieved.

### **1.4.2.5 Comparability**

Comparability is an expression of the confidence with which one data set can be compared against another. Comparability is a qualitative function of the sampling and analysis methods. To assure that one data set can be compared to another, the sampling and analysis methods will follow well-documented standard procedures and typical reporting units will be used.

### **1.4.2.6 Sensitivity**

Sensitivity is the ability of the method to detect the contaminant of concern at the concentration of interest (regulatory clean up standard). QC measures which aid in evaluating sensitivity are field rinsate blanks, trip blanks, and laboratory method blanks. These QC samples are used to ensure that field or laboratory practices do not introduce contaminants, which may positively

bias laboratory results. Method reporting limits are set at a level equal to that of the low level standard of the instrument calibration curve.

Sensitivity requirements for this program will depend on the media of concern. Soil and water analyses will be designed, where possible, to meet the nominal practical quantitation limits for each analyte presented in the NJDEP Guidance documents, cleanup criteria, and screening criteria. To the degree possible, analyses will be conducted to provide adequate sensitivity to demonstrate Site conditions with respect to the applicable NJ criteria defined in the identified technical guidelines.

## **1.5 DOCUMENTATION AND RECORDS**

All records generated during this project will be kept on file by KEY on behalf of The Group. These records may include: field log books, field sampling forms, chain of custody forms, laboratory data deliverables, photographs, and other relevant records.

Revisions and updates to this QAPP will be prepared as The Group and/or KEY deem necessary, and/or based upon conditions observed in the field. A full review of the QAPP will be performed if work has not been completed within five years and updates will be incorporated as necessary. This will ensure that laboratory changes or method improvements are addressed, and that changes to program objectives, or scope that may be made as a result of the information gathered in the initial program stages, are incorporated into the overall QA/QC program. Changes to the QAPP will be fully documented and signed by the Group technical representatives and KEY Project Manager and QA Officer.

## **2.0 MEASUREMENT DATA ACQUISITION**

### **2.1 SAMPLING METHODS**

Sampling methods, decontamination procedures, and management of investigation-derived waste are discussed in the attendant Field Sampling Plan (Appendix F).

### **2.2 SAMPLING HANDLING AND CUSTODY**

Sample handling and custody are discussed in detail in Section 8.0 of the attendant Field Sampling Plan (Appendix F).

### **2.3 ANALYTICAL METHODS**

The analytical procedures to be used for the data acquisition activities include a combination of EPA and ASTM methods, as well as specific methods to be completed in accordance with laboratory SOPs. The specific analytical methods to be used for the IRA are as follows:

- USCS classification (ASTM D2487)
- Moisture content (ASTM D2216)
- Gradation (ASTM C136)
- Hydrometer analysis (ASTM D422)
- Atterberg limits (ASTM D4318)
- Specific gravity (ASTM D854)
- One-dimensional consolidation (ASTM D2435)
- Consolidated undrained triaxial shear (ASTM D4767)
- TCL Volatile Organic Compounds (SW-846 Method 8260B)
- TCL Semi-Volatile Organic Compounds (SW-846 Method 8270C)
- TCL Pesticides (SW-846 Method 8081A)
- TCL Polychlorinated Biphenyls (SW-846 Method 8082)
- Hexavalent Chromium (SW-846 Method 3060A/7196A or 7199)
- TAL Metals (SW-846 6000 and 7000 Series Methods)
- Cyanide (SW-846 Method 9012A)
- Specific gravity (ASTM D1298)
- Interfacial tension (ASTM D971)
- Viscosity (ASTM D445)
- Dioxins/furans (SW-846 Method 8290)
- Total Organic Halogens (SW-846 Method 9020)
- Water content (Karl Fisher Titration Method)
- Ignitability (SW-846 Method 1010A)
- Reactivity (SW-846 Method 9030A)
- British Thermal Unit Content (ASTM D240)
- pH (SW-846 Method 9040C)
- Total Suspended Solids (EPA Method 160.2)

- Total Dissolved Solids (EPA Method 160.1)
- Alkalinity (EPA Method 310.1)
- Oil and Grease (SW846 Method 9070)
- Total Organic Carbon (EPA Method 414.1)
- Biochemical Oxygen Demand (EPA Method 405.1)
- Chemical Oxygen Demand (EPA Method 410.1)
- TCLP Volatiles (SW-846 Method 1311/8260B);
- TCLP Semi-volatiles (SW-846 Method 1311/8270C);
- TCLP Inorganics (SW-846 Method 1311/6000 and 7000 Series);
- 28-day Permeability (ASTM D5084);
- Bulk Density (ASTM D2937); and,
- Grain Size Analysis (ASTM D422); and,
- In-place Bulk Density (ASTM D2937).

Detailed information and quality control requirements will be provided in the subcontract laboratory's Laboratory Quality Manual (LQM). The analytical chemistry subcontract laboratory for the project has not been selected at this time. However, an NJDEP-certified laboratory will be used for all analysis completed during the IRA. A copy of the subcontract laboratory's LQM will be provided upon request.

## **2.4 QUALITY CONTROL**

This section discusses field and laboratory quality control requirements. Laboratory quality control requirements are dictated, in large part, by the analytical methods. Additional aspects of laboratory quality control are addressed in the subcontract laboratory's LQM.

### **2.4.1 Field Quality Control Requirements**

Quality control in the field will be maintained through equipment calibration (discussed in Section 2.6.1 of this QAPP), measurement reproducibility, and the collection of QC samples.

#### **2.4.1.1 Field Quality Control Samples**

Quality control for field sampling efforts will primarily be measured via the collection of field QC samples, which consist of the following:

- Field duplicates;
- Equipment blanks;
- Trip blanks.

The data application and sample requirements for each are discussed in the following paragraphs.

### ***Field Duplicates***

Field duplicates are used to evaluate the sample collection and analyses effects on the reproducibility of data. Field duplicates are collected by splitting a sample evenly between the primary sample and QA/QC sample containers. For instance, a groundwater sample bailer would be emptied, in relatively equal volumes, into two sample containers (one for the primary sample of record and one for the QA/QC duplicate). DNAPL samples will be handled in a similar manner.

Field duplicates of soil samples for all analyses except volatile organics will be taken by homogenizing the soil in a stainless steel bowl and then placing replicate portions into the sample containers. Field duplicates for volatile analyses will be collected as separate samples from the same location or boring depth.

Preservation will be performed as necessary for the appropriate analysis. One field duplicate for each chemical analysis for each sampling event or one per every 20 samples will be collected, whichever is greater. Duplicates samples will not be obtained for geotechnical parameters.

### ***Equipment Blanks***

Equipment blank data are used to evaluate field decontamination procedures. Equipment blanks will be collected by pouring analyte-free water, supplied by the analytical laboratory, through a decontaminated sample bailer or low flow purging and sampling device or over decontaminated soil sampling utensils into the sample bottles. Preservation and filtration will be performed as necessary for the appropriate analyses. For equipment that is decontaminated and re-used, one equipment blank will be collected per day for each type of equipment used.

If disposable equipment is used, the equipment blank will be taken from a rinse of the equipment prior to sampling use. One field blank per sampling event will be sufficient for each type of disposable instrument used. Equipment blanks will be analyzed for chemical parameters on a matrix-specific basis, as follows:

- Soil Samples – TCL VOCs and SVOCs;
- Groundwater Samples - TCL VOCs and SVOCs; TAL metals, total chromium, hexavalent chromium; and,
- DNAPL Samples - VOCs, SVOCs; TAL metals; Polychlorinated Biphenyls; dioxins/furans.

### ***Trip Blanks***

Trip blank data will be used to evaluate exposure to volatile organic constituents during sampling, shipping and storage at the laboratory. Trip blanks will be prepared by the analytical laboratory and will be shipped with the VOC vials. Trip blanks for the groundwater and DNAPL samples will consist of analyte free de-ionized water. Trip blanks for soil samples (if soil samples for chemical analysis are obtained) will consist of methanol. Trip blanks for a particular

date of sample collection will be transported to the laboratory in the sample shipment container with all other VOC samples for that date. One set of trip blanks will be included in each cooler containing VOC sample vials and will be analyzed for the same list of VOCs as the primary samples.

## **2.4.2 Laboratory Quality Control Requirements**

Quality control data are necessary to determine precision and accuracy of the analyses, and to demonstrate the absence of interferences and contamination of glassware and reagents. Laboratory-generated QC will consist of blanks, replicates, standards, matrix spikes, surrogate spikes and blanks. These will be prepared and analyzed at the method-required frequencies. Method-recommended matrix spiking solutions will be used to determine matrix effects. Surrogates will be added to all samples requiring gas chromatography analyses (or as specified in the method). At a minimum, one method blank will be processed for every batch (up to 20 samples) analyzed. Blank samples will be analyzed in order to assess possible contamination and determine which corrective measures may be taken, if necessary.

### ***Laboratory Duplicates***

Replicate samples are aliquots of a single sample that are split upon arrival at the laboratory or prior to analysis. Laboratory duplicates are required by methods for inorganic analyses. Since it is anticipated that the concentrations of most organic parameters will be below the laboratory detection limits, precision data on replicate analyses will largely be derived from matrix spike duplicate data. Significant differences between two replicates that are split in a controlled laboratory environment will result in flagging of the affected analytical results.

### ***Surrogate Analysis***

Surrogate spike analysis is used to determine the recovery efficiency of analytes in the sample preparation and analysis. Calculated percentage recovery of the spike is used as a measure of the accuracy of the total analytical method. A surrogate spike is prepared by adding to a sample (before extraction) a known amount of pure compound similar to that for which the sample is being analyzed. Surrogate compounds will be added to all samples that are to be analyzed for volatiles and semi-volatiles, including method blanks, duplicate samples, and matrix spikes using the compounds recommended in the respective methods. If a recovery does not fall within these limits, the corrective actions described in the method will be implemented.

### ***Matrix Spike/Matrix Spike Duplicate Analysis***

This technique is used to determine the effect of matrix interference on analytical results. Aliquots of the same sample are prepared in the laboratory and each aliquot receives consistent treatment throughout the analytical method. Spikes are added at concentrations specified in the methods. Spike duplicates are prepared for organic analyses. The percent difference between the values of the spike duplicates is taken as a measure of the precision of the analytical method.



### **Method Blanks**

Method blanks will be run for all appropriate chemical analyses to verify that the procedures used do not introduce contaminants that affect the analytical results. The method blank will be prepared by addition of all reagents to a substance of similar matrix as the sample. This blank will then undergo all of the procedures required for sample preparation. The resultant solution will be analyzed with the field samples prepared under identical conditions.

Deviations from the established QC criteria will be noted and reanalysis, or other corrective action, will be instituted as appropriate for the situation.

## **2.5 EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE**

Equipment condition and maintenance activities will be noted in the field notebooks and may include:

- Cleansing of the ionization chamber, lamp window, and any filters on a PID, FID, or multimeter; and,
- Daily inspections of sampling equipment and measurement systems for possible problems (e.g., cracked or clogged lines or tubing or weak batteries).

Spare and replacement parts stored in the field to minimize downtime may include:

- Appropriately sized batteries;
- Locks;
- Decontamination supplies;
- Extra sample containers;
- Bailers;
- Bailer line;
- Stainless steel bowls and spatulas/spoons;
- Calibration kit(s), battery charger, and support equipment;
- Health and safety supplies; and,
- Tool kit.

If damaged equipment is identified, it will be replaced by the same or equivalent model as soon as is practicable. Field QA issues will be reported to the KEY Project Manager and QA Officer. Problems encountered during the program affecting quality will be reported. The Project Manager/QA Officer will be responsible for initiating the corrective actions and for ensuring that the actions are taken in a timely manner and that the desired results are produced.

During the course of the corrective actions, the field personnel will be responsible for seeing that field instruments are functioning properly and that work progresses satisfactorily. Additionally, field personnel are responsible for the performance of routine preventative maintenance and QC procedures, thereby ensuring collection of valid field data.

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## **2.6 INSTRUMENT CALIBRATION AND FREQUENCY**

This section discusses instrument calibration procedures and frequency of calibration. Field instrument calibration is discussed in Section 2.6.1. Laboratory instrument calibration is discussed in Section 2.6.2.

### **2.6.1 Field Instrument Calibration**

Precision and accuracy of field measurements will be maintained in two ways:

- Through daily calibration of each instrument or in accordance with the manufacturer's recommended procedures, if such procedures exist; and,
- By checking the reproducibility of the measurement by obtaining and recording multiple readings.

#### **2.6.1.1 Equipment Requirements**

The following field equipment is anticipated for use during the IRA, for various screening, monitoring, and measurement tasks:

- Electronic water depth measuring devices (E-tapes) and oil-water interface probes;
- PID or FID; and,
- Field meters for measuring pH, turbidity, temperature, dissolved oxygen, specific conductance (such as a Horiba™).

#### **2.6.1.2 Calibration Requirements**

All equipment will be calibrated daily for each day of use, more frequently if necessary, and/or per manufacturer's recommendations. Calibration information is to be recorded in the field notebook. If calibration difficulties are experienced for a given piece of equipment, KEY or subcontractor responsible for equipment upkeep will replace the equipment with a similar, or equivalent model, as soon as is practicable.

### **2.6.2 Laboratory Instrument Calibration**

Calibration of laboratory equipment will be accomplished according to published procedures associated with specific methods of analysis, if any, and U.S. EPA guidance. Records of calibration, repairs, or replacement will be filed and maintained by the designated laboratory personnel performing quality control activities. These records will be filed at the location where the work is performed and will be subject to a QA audit. For all instruments, the laboratory will maintain a factory-trained repair staff with in-house spare parts, or maintain service contracts with vendors.

## **2.7 DATA ACQUISITION**

Data will be transferred electronically or by computer diskette directly from the laboratory to KEY. Once received by KEY, data will be reduced and formatted in easily interpreted tables in Excel format for incorporation into a Graphical Data Management and Visualization System (GDMVS). From this format, data will also be electronically transferred into KEY's GDMVS and in NJ HazSite electronic data deliverable (EDD) format. The data format required by KEY for production of the NJ HazSite EDD is presented in SOP #155 (included in Attachment A).

## **2.8 DATA MANAGEMENT**

The analytical, survey, and geological data (electronic and hardcopy) will be managed and maintained by KEY. Any requests for these data by third parties must be first approved by the Group. Data management for the project has the following objectives:

- Establish a controlled, functional, and efficiently operated data management system and accompanying procedures to manage, analyze, document, and transfer the environmental data that are collected and generated.
- Maintain a usable and accurate database throughout the life of the project.
- Support processing of specific data requests from project and Group personnel.
- Support transfer specific data components to other parties, as appropriate.
- To allow archiving of the data and related documentation upon closure of the project.

### **2.8.1 Data Transmittal, Transformation, and Analysis**

Upon receipt of data from the analytical laboratory, KEY personnel will ensure that all data packages are complete. If data packages are determined to be incomplete, the laboratory will be contacted and will be required to promptly provide the missing information. KEY personnel will be responsible for transcribing all data, including electronically transferred data (i.e., EDDs), into tables suitable for data review. After review and any necessary validation, field and laboratory data will be entered into the database with appropriate qualifiers.

KEY personnel will review Level III data to ascertain that the laboratory has provided the following information:

- Results for all samples submitted;
- Correct reporting units;
- Documentation of acceptable matrix spike duplicate and surrogate recoveries;

- Acceptable standard and preparation blank results; and,
- Appropriate qualifiers of data for which results are reported below the applicable detection limit or for analytes that are also detected in method or preparation blanks.

Any difficulties originating from the EDD format shall be resolved with the laboratory before the data are imported. Upon importing analytical data, a random sampling will be verified against the associated hard copy data and a copy of the reviewed electronic data printout will be annotated, signed, and retained in the project file.

Tables containing analytical data will be generated through queries from the database and results will be compared to appropriate regulatory criteria. Geographic Information System (GIS) data may be used to generate boring logs, groundwater flow maps, and vertical and lateral iso-concentration plots. Geologic data obtained from boring logs, well construction information, and survey coordinates and elevations will also be entered. The data will be reviewed for accuracy and completeness.

### **2.8.2 Data Storage and Retrieval**

All electronic data will be maintained in the KEY database and will be accessed and managed by KEY. All records will be maintained by KEY following project completion and closeout until directed otherwise by the Group.

### **3.0 ASSESSMENT/OVERSIGHT**

#### **3.1 ASSESSMENT AND RESPONSE ACTIONS**

The oversight of the project activities may include a process of review and evaluation through systems audits, field audits, internal peer review, and laboratory oversight. This process will ensure that the QAPP is adhered to, the quality of the data is adequate, and corrective actions, when needed, are implemented effectively and in a timely manner.

##### **3.1.1 Technical Systems Audits**

Systems audits performed by the Quality Assurance Officer or designee may encompass evaluation of QA components to ascertain their appropriate selection and application. In addition, field and laboratory quality control procedures and associated documentation may be system audited. These audits will be conducted if conditions that may compromise quality are detected, and/or if The Group requests an unscheduled audit. The Systems Audit will consist of an inspection of the following procedures:

- Sampling
- Sample custody
- Sample storage and preservation
- Sample preparation
- Analytical methodology
- Data management
- Preventive maintenance
- Recordkeeping

##### **3.1.2 Technical Performance Audits**

Performance audits may be conducted periodically through the duration of the project to determine the accuracy and implementation of the QA/QC Plan. As in system audits, unplanned audits may be implemented if requested. Performance audits will be performed after sampling activities commence and the project begins to generate data. These audits document that sampling, custody, and record-keeping in the field are in compliance with applicable requirements of the QAPP. In addition to in-house performance audits, the laboratory will also participate in inter-laboratory performance evaluation studies.

###### **3.1.2.1 Field Performance Audits**

A QA audit may be conducted at the discretion of the Project Manager to ensure that field personnel comply with the IRAW and applicable SOPs. Each audit shall cover the items necessary to verify proper control of the activities within the defined scope of work. Concerns such as equipment inspections and calibration, personnel training, decontamination, field

screening, sample collection, sample shipping and chain-of-custody procedures, and document control are included in a field audit.

The mobilization stage may be audited before work begins to assure that all procedures, training, and materials are in place to support the QA Plan. Field activities may be audited during the initial stage to assure compliance with the QA Plan. Additional audits may be required depending on the results of these audits. All audits and corrective actions will be reported in writing to the Project Manager.

### **3.1.2.2 Laboratory Audits**

New Jersey certified laboratories will be used for analysis of all Site-related constituents of interest (COIs) in this program. If conditions are noted that indicate potential quality issues with analytical results, an audit may be conducted at the recommendation of the Quality Assurance Manager. This audit shall consist of a general audit and a specific procedure audit. A general audit will be an overview of the whole laboratory from sample receipt to sample disposal. A specific technical audit will be a detailed in-depth review of an actual method or procedure.

The findings from any audit conducted will be documented on a laboratory audit record form. Any issues, observations, and findings shall be discussed with the Laboratory Manager. The results of the audit shall be kept on file along with any corrective action taken. If, as a result of the audit, there is uncertainty as to the validity or correctness of a test result, immediate corrective action should be taken and the client notified in writing.

## **3.2 CORRECTIVE ACTION PROTOCOLS**

Project management and staff, including field investigation teams, quality assurance auditors, document, sample control personnel, and laboratory groups, will monitor ongoing work performance in the normal course of daily responsibilities. When a significant condition adverse to quality is noted at the project location or laboratory, the cause of the condition will be determined and corrective action taken to preclude repetition. Condition identification, cause, reference documents, and corrective action planned and taken will be documented and reported to the Project Manager. Implementation of correction action will be verified by documented follow-up action. All project personnel have the responsibility, as part of their normal work duties, to promptly identify and report conditions adverse to quality, and solicit correction. Corrective actions may be initiated under the following (for example):

- When predetermined acceptance standards are not attained (objectives for precision, accuracy, and completeness);
- When procedures or data compiled are determined to be incorrect or incomplete;
- When equipment or instrumentation is found to be malfunctioning;
- When samples and test results cannot be traced with certainty;

- When quality assurance requirements have been violated;
- When designated approvals have been circumvented;
- As a result of system and performance audits; or,
- As a result of a management assessment.

Corrective actions shall be documented using appropriate field and laboratory forms. All corrective action forms shall be entered into the project files.

### **3.3 REPORTS TO MANAGEMENT**

As needed, reports will be prepared by KEY and submitted to the Group. Quality assurance reports to management will consist of reports on audits, reports on correction of deficiencies found in audits, a final QA report on field sampling activities, and a final analytical laboratory QA/QC report.

## **4.0 DATA VALIDATION AND USABILITY**

### **4.1 DATA REVIEW, VALIDATION, AND VERIFICATION**

This section discusses data review, validation, and verification. Field data are discussed in Section 4.1.1. Laboratory data are discussed in Section 4.1.2.

#### **4.1.1 Field Data**

Field data will be reviewed using four different procedures:

- Routine checks will be made during the processing of data, e.g., looking for potential transcription errors;
- Internal consistency of a data set will be evaluated. This step will involve plotting the data and testing for outliers;
- Checks for consistency of the data set over time will be performed. This can be accomplished by visually comparing data sets against gross upper limits obtained from historical data sets, or by testing for historical consistency; and,
- Checks will be made for consistency with parallel data sets; i.e., data sets obtained from the same population (for example, from the same region of the aquifer).

The purpose of these validation checks and tests is to identify outliers; i.e., an observation that does not conform to the pattern established by other observations. Outliers may be the result of transcription errors or instrumentation breakdowns. Outliers may also be manifestations of a greater degree of spatial or temporal variability than expected.

After an outlier has been identified, a decision concerning its factual basis must be made. Obvious mistakes in data will be corrected when possible, and the correct values inserted. If the correct values cannot be obtained, the data may be excluded. An attempt will be made to explain the existence of the outlier. If no plausible explanation can be found for the outlier, it may be excluded, but a note to that effect will be included in the report. Also, an attempt will be made to determine the effect of the outlier with both inclusion and exclusion from the data set.

#### **4.1.2 Laboratory Data**

Prior to submitting analytical data to KEY, the laboratory must verify compliance to the method requirements. The laboratory will follow their QA/QC manual, SOPs, and this QAPP for all sample analyses. The laboratory will also be responsible for the oversight of the data quality for all analyses. Any sample integrity issues, discrepancies with the chain-of-custody, or concerns with the analysis will be addressed and resolved through the laboratory QA Officer.



All analytical data and calculations shall be reviewed by the laboratory and shall include a minimum of three levels of documented review, including analyst review, peer review, and supervisory review. For each level, the review process shall be documented, signed and dated by the reviewer. Each step of this review process shall include the evaluation of data quality based on both the results of the QC data and the professional judgment of those conducting the review. All electronic deliverables must be checked against the hard-copy reports to ensure that the two versions match.

Laboratory data deliverables as specified in N.J.A.C. 7:26E - Appendix A, shall be followed, specifically:

- a) New Jersey reduced laboratory data deliverables shall be submitted for all chemical analyses; and,
- b) Analytical results without all QC and raw data, as required in full and reduced laboratory data deliverables, may be provided for all delineation samples which necessitate additional delineation sampling and for all long-term groundwater monitoring samples; data deliverables will contain, at a minimum:
  - A cover page, including facility name and address, laboratory name and address, laboratory certification number, if applicable, date of analytical report preparation and signature of laboratory director;
  - A listing of all field sample identification numbers and corresponding laboratory sample identification numbers;
  - A listing of all analytical methods used;
  - The method detection limit and practical quantitation level for each analyte for each sample analysis;
  - All sample results including date of analysis;
  - All method blank results; and,
  - All chain of custody documentation.

## **4.2 VALIDATION AND VERIFICATION METHODS**

Third party data validation is not considered necessary for the purposes of the IRA which will not include any crucial risk assessment associated decisions. Nonetheless, in the event that validation is deemed necessary, it will be completed in accordance with guidance as outlined in the NJDEP's Bureau of Environmental Measurements and Quality Assurance SOPs for data validation (i.e., BEMQA SOPs 5.A.13 and 5.A.16).

As required, these guidance documents will be used in conjunction with the laboratory SOPs for the respective analytical methods. Professional judgment will be exercised throughout the validation effort, particularly for situations that are not addressed or clearly specified in the SOPs or in the guidance documents.

### **4.3 RECONCILIATION WITH DATA QUALITY OBJECTIVES**

Results from review/validation of field activities and analytical data will be integrated to allow a final reconciliation of achieved data quality with the stated DQOs.

Accuracy, precision, and completeness will be evaluated in accordance with the formulas provided in this document. Representativeness will be evaluated based on the implementation of the field sampling program and analytical program with attention paid to evidence of non-homogeneity of samples. Reporting limits will be compared to applicable criteria to evaluate whether adequate sensitivity was achieved. Sampling and analysis methods and results will be reviewed against historical data or data from other related locations to determine comparability.

#### **4.3.1 Data Quality Assessment**

The KEY QA Officer will identify any areas of concern where objectives were not met and evaluate the impact of these upon the intended uses of the data. Specific samples or analytes for which the uncertainty exceeds program or project-specific objectives will be identified so that the Group may make informed decisions on the potential impact to the overall program.

## REFERENCES

NJDEP (New Jersey Department of Environmental Protection), *Field Sampling Procedures Manual*, August 1995.

N.J.A.C. Chapter 26E, *Technical Requirements for Site Remediation*, including most recent supplements.

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U.S. EPA, *Contract Laboratory Program, National Functional Guidelines for Organic Data Review*.

U.S. EPA, *Contract Laboratory Program, National Functional Guidelines for Inorganic Data Review*.

U.S. EPA, *Guidance for the Data Quality Objectives Process*, EPA QA/G-4, September 1994.

U.S. EPA, *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations*, EPA QA/G-5, February 1998.

U.S. EPA, *Data Quality Objectives for Remedial Response Activities*, OSWER Directive 9355.0-7B, March 1987.

## **TABLES**

TABLE 1  
SUMMARY OF DESIGN DATA ACQUISITION SAMPLING AND ANALYSIS<sup>(1)</sup>  
SCCC AND DIAMOND SITES  
KEARNY, NEW JERSEY

Location	Description	IRAW Text Section	Sample Matrix	Boring Depth (ft)	Sample Depth (ft)	Required Analyses <sup>(2)</sup>																							Sampling Method	Purpose	
						TCL VOCs	TCL SVOCs	TAL Metals	Hexavalent Chromium	TCL PCBs	PCDD & PCDF	Cyanide	TCLP	RCRA	BTU Content	TCL Pesticides	TSS	TDS	Alkalinity	BOD	COD	TOC	Oil & Grease	Field Parameters	TOX	Physical Suite A	Physical Suite B	Physical Suite C			Physical Suite D
SOIL/LAGOON SOLIDS/SEDIMENT WASTE CLASSIFICATION SAMPLING																															
BW-1 through BW-20	Slurry Wall Spoils Classification Samples	4.1	Soil	30-60	0-60																									Split Spoons	Characterization of Slurry Wall Spoils for Backfill/Consolidation/Disposal
WLWC-001 through WLWC-004	West Lagoon Solids	4.4	Solids	-	~0-6																									Excavator	West Lagoon Waste Classification Sampling and Analysis
ELWC-001 through ELWC-006	East Lagoon Solids	4.4	Solids	-	~0-6																									Excavator	East Lagoon Waste Classification Sampling and Analysis
HRWC-01 through HRWC-06	Near-Shore River Sediment	4.5	Sediment	-	0-3																									Hand Auger	Hackensack River Sediment Waste Classification Sampling and Analysis
SDWC-01 through SDWC-05	South Ditch Sediment	4.7	Sediment	-	0-2																									Hand Auger	South Ditch Soft Sediment Waste Classification Sampling and Analysis
GROUNDWATER TREATMENT PLANT DESIGN SAMPLES																															
Shallow Fill Zone Monitoring Wells <sup>(3)</sup>	Groundwater Treatment Plant Design Samples	4.2	Ground Water	-	Upper Zone (Fill)																									Low Flow	Groundwater Treatment System Design
Deeper Sand Zone Monitoring Wells <sup>(3)</sup>	Groundwater Treatment Plant Design Samples	4.2	Ground Water	-	Lower Zone (Sand)																									Low Flow	Groundwater Treatment System Design
LAGOON DEWATERING TREATMENT PLANT DESIGN SAMPLES																															
WLSW-01 & WLSW-02 ELSW-01 & ELSW-02	Lagoon Storm Water Samples	4.4	Storm Water	-	Grab																									Grab Samples	Temporary Treatment Plant Design
DNAPL CHARACTERIZATION SAMPLES																															
MW-3L & MW-13L	DNAPL Chemical and Physical Samples	4.3	DNAPL	NA	Bottom of Well																									Low Flow	Recovery System Design and Recycling/Disposal Assessment
GEOTECHNICAL/PHYSICAL PARAMETER SOIL SAMPLES																															
GT-5 through GT-7	Geotechnical Analysis for Structural Wall Design	4.1	Soil	60	0-60																									Split Spoons Shelby Tubes	Engineering Analysis of Barrier Wall
BW-1 through BW-7	Geotechnical Analysis for Structural Wall Design	4.1	Soil	60	0-60																									Split Spoons Shelby Tubes	Engineering Analysis of Barrier Wall
BW-8 through BW-20	Geotechnical Analysis for Structural Wall Design	4.1	Soil	30	0-30																									Split Spoons Shelby Tubes	Engineering Analysis of Barrier Wall
DS-1 through DS-6	DNAPL Recovery System Borings	4.3	Soil	30	0-30																									Split Spoons Shelby Tubes	Recovery Well Slot Size and Screen Length Determination
GT-1 through GT-4	Geotechnical Analysis for Stability/Settlement Analysis	4.4	Soil	30	0-30																									Split Spoons Shelby Tubes	Engineering Analysis of Interim Surface Cover - Lagoon Settlement

1. Sampling and analysis includes collection of chemical and physical characterization data as well as geotechnical data. Samples for geotechnical analysis will be a subset of multiple geotechnical samples collected during the drilling program.
2. The various analytical parameters and suites of analysis are as follows (where not self-evident):

TCL VOCs - Target Compound List Volatile Organic Compounds  
TCL SVOCs - Target Compound List Semi-Volatile Organic Compounds  
TAL Metals - Target Analyte List Metals

TCL PCBs - Target Compound List Polychlorinated Biphenyls  
PCDD/PCDF - Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans.  
TCLP - Toxicity Characteristic Leaching Procedure VOCs, SVOCs, and Metals

RCRA - Corrosivity, Ignitability, Reactivity  
TSS - Total Suspended Solids  
TDS - Total Dissolved Solids  
BOD - Biological Oxygen Demand  
COD - Chemical Oxygen Demand  
TOC - Total Organic Carbon

BTU - British Thermal Unit  
TOX - Total Organic Halogens

Physical Suite A - Grain Size, Total Organic Carbon, Moisture Content.  
Physical Suite B - Specific Gravity, Viscosity, Interfacial Tension, Moisture Content.  
Physical Suite C - USCS Soil Classification, Moisture Content, Gradation, Hydrometer Analysis, Atterberg Limits, Specific Gravity, One-Dimensional Consolidation, Consolidated Undrained Triaxial Shear (3 points each), Permeability, Bulk Density.  
Physical Suite D - UCSC Soil Classification, Gradation, Hydrometer Analysis.  
Physical Suite E - USCS Soil Classification, Moisture Content, Gradation, Hydrometer Analysis, Atterberg Limits, Consolidated Undrained Triaxial Shear (3 points each).

Field parameter analysis for groundwater samples consists of pH, Oxidation-Reduction Potential (ORP), Specific Conductance, Temperature, Turbidity, Water Levels, DNAPL Thickness.  
Field parameter analysis for storm water samples consists of pH, ORP, Specific Conductance, Temperature, and Turbidity.

3. Barrier wall alignment borings BW-1 through BW-8 to be installed to a depth of 60 feet. Barrier wall alignment borings BW-9 through BW-20 to be installed to a depth of 30 feet.
4. Groundwater samples will be obtained to support design of the groundwater treatment system. Samples will be obtained from shallow fill zone and deeper sand zone wells. Wells to be sampled are as follows:

Shallow Fill Zone Wells	113-W-113	113-W-115	113-W-120	SC-PZ-1U	SC-PZ-3U	SC-PZ-5U	SC-PZ-12U	SC-PZ-15U
	113-W-114	113-W-116	113-W-121	SC-PZ-2U	SC-PZ-4U	SC-PZ-11U	SC-PZ-14U	MW-109
Deeper Sand Zone Wells	SC-MW-2L	SC-MW-3L	SC-MW-4L	SC-MW-8L	SC-MW-12L	SC-MW-13L	SC-MW-14L	SC-MW-15L

TABLE 2  
QUALITY CONTROL SAMPLE, ANALYTICAL METHOD, SAMPLE CONTAINER, PRESERVATION, AND HOLDING TIME REQUIREMENTS  
SCCC AND DIAMOND SITES  
KEARNY, NEW JERSEY

Matrix Sample Summary			QA Sample Frequency				Analytical Requirements Summary				
Analytical Parameter <sup>(1)</sup>	Sample Matrix <sup>(2)</sup>	Estimated No. of Samples	Field Duplicates	Equipment Blanks <sup>(3)</sup>	MS/MSDs	Trip Blanks	Method Reference <sup>(4)</sup>	Bottle Type	Required Sample Volume <sup>(5)</sup>	Preservation	Holding Time
ORGANICS											
TCL VOCs	Barrier Wall Soil Borings	60	3	1/day or 1/event	3/3	1/trip	SW846 5035A SW846 8260B	Glass	4 x 40 ml or Encore™ or equivalent field core sampling. Additional for % solids.	1 x 5 ml methanol; 2 x 5 ml sodium bisulfate; 1 x 5 ml water	14 days from collection if field preserved. Preservation within 48 hours if lab preserved.
	Ground Water	24	2	1/day or 1/event	2/2	1/trip	SW846 8260B	Glass with Teflon™-lined septum.	2 x 40 ml vials	4°C, HCl to pH<2	14 days.
	Lagoon Water	4	1	1/day or 1/event	1/1	1/trip	SW846 8260B	Glass with Teflon™-lined cap	2 x 40 ml vials	4°C, HCl to pH<2	14 days.
	River and South Ditch Sediment	11	1	1/day or 1/event	1/1	1/trip	SW846 8260B	Glass with Teflon™-lined cap	4 ounces	4°C	14 days.
	Lagoon Solids	10	1	1/day or 1/event	1/1	1/trip	SW846 8260B	Glass with Teflon™-lined cap	4 ounces	4°C	14 days.
TCL SVOCs	Barrier Wall Soil Borings	60	3	1/day or 1/event	3/3	--	SW846 8270C	Glass	100 grams	4°C	7 days to extraction/40 days to analysis.
	Ground Water	24	2	1/day or 1/event	2/2	--	SW846 8270C	Glass with Teflon™-lined cap (amber)	2 Liters	4°C	7 days to extraction/40 days to analysis.
	Lagoon Water	4	1	1/day or 1/event	1/1	--	SW846 8270C	Glass with Teflon™-lined cap (amber)	2 Liters	4°C	7 days to extraction/40 days to analysis.
	River and South Ditch Sediment	11	1	1/day or 1/event	1/1	--	SW846 8270C	Glass	100 grams	4°C	7 days to extraction/40 days to analysis.
	Lagoon Solids	10	1	1/day or 1/event	1/1	--	SW846 8270C	Glass	100 grams	4°C	7 days to extraction/40 days to analysis.
TCL Pesticides	Ground Water	24	2	1/day or 1/event	2/2	--	SW846 8081A	Glass with Teflon™-lined cap (amber)	2 Liters	4°C	7 days to extraction/40 days to analysis.
PCDD & PCDF	Barrier Wall Soil Borings	60	3	1/day or 1/event	--	--	SW846 8290	4-oz glass	25 mg	4°C	1 year
	River and South Ditch Sediment	11	1	1/day or 1/event	--	--	SW846 8290	4-oz glass	25 mg	4°C	1 year
	Lagoon Solids	10	1	1/day or 1/event	--	--	SW846 8290	4-oz glass	25 mg	4°C	1 year
	DNAPL Samples	2	1	1/day or 1/event	--	--	SW846 8290	4-oz glass	25 mg	4°C	1 year
TCL PCBs	Barrier Wall Soil Borings	60	3	1/day or 1/event	3/3	--	SW846 8082	Glass	4 ounces	4°C	7 days to extraction/40 days to analysis.
	Ground Water	24	2	1/day or 1/event	2/2	--	SW846 8082	Amber glass	1 liter	4°C	7 days to extraction/40 days to analysis.
	River and South Ditch Sediment	11	1	1/day or 1/event	1/1	--	SW846 8082	Glass	4 ounces	4°C	7 days to extraction/40 days to analysis.
	Lagoon Solids	10	1	1/day or 1/event	1/1	--	SW846 8082	Glass	4 ounces	4°C	7 days to extraction/40 days to analysis.
	DNAPL Samples	2	1	1/day or 1/event	1/1	--	SW846 8082	Amber glass	1 liter	4°C	7 days to extraction/40 days to analysis.

TABLE 2  
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SCCC AND DIAMOND SITES  
KEARNY, NEW JERSEY

Matrix Sample Summary			QA Sample Frequency				Analytical Requirements Summary				
Analytical Parameter <sup>(1)</sup>	Sample Matrix <sup>(2)</sup>	Estimated No. of Samples	Field Duplicates	Equipment Blanks <sup>(3)</sup>	MS/MSDs	Trip Blanks	Method Reference <sup>(4)</sup>	Bottle Type	Required Sample Volume <sup>(5)</sup>	Preservation	Holding Time
INORGANICS											
TAL Metals	Barrier Wall Soil Borings	60	3	1/day or 1/event	--	--	SW846 6000 and 7000 series	Glass	100 grams	4°C	28 days for Hg; 6 months for other metals
	Ground Water	24	2	1/day or 1/event	--	--	SW846 6000 and 7000 series	Plastic or glass	500 ml	HNO <sub>3</sub> to pH<2; 4°C	28 days for Hg; 6 months for other metals
	Lagoon Water	4	1	1/day or 1/event	--	--	SW846 6000 and 7000 series	Plastic or glass	500 ml	HNO <sub>3</sub> to pH<2; 4°C	28 days for Hg; 6 months for other metals
	River and South Ditch Sediment	11	1	1/day or 1/event	--	--	SW846 6000 and 7000 series	Glass	100 grams	4°C	28 days for Hg; 6 months for other metals
	Lagoon Solids	10	1	1/day or 1/event	--	--	SW846 6000 and 7000 series	Glass	100 grams	4°C	28 days for Hg; 6 months for other metals
Hexavalent Chromium	Barrier Wall Soil Borings	60	3	1/day or 1/event	--	--	SW846 7196	Plastic or glass	100 grams	4°C	28 days
	Ground Water	24	2	1/day or 1/event	--	--	SW846 7196	Plastic or glass	500 ml	4°C	24 hours
	River and South Ditch Sediment	11	1	1/day or 1/event	--	--	SW846 7196	Plastic or glass	100 grams	4°C	28 days
	Lagoon Solids	10	1	1/day or 1/event	--	--	SW846 7196	Plastic or glass	100 grams	4°C	28 days
	DNAPL Samples	2	1	1/day or 1/event	--	--	SW846 7196	Plastic or glass	100 grams	4°C	24 hours
Cyanide	Barrier Wall Soil Borings	60	3	1/day or 1/event	--	--	SW846 9012A	Plastic or glass	100 grams	4°C	14 days
	River and South Ditch Sediment	11	1	1/day or 1/event	--	--	SW846 9012A	Plastic or glass	100 grams	4°C	14 days
	Lagoon Solids	10	1	1/day or 1/event	--	--	SW846 9012A	Plastic or glass	100 grams	4°C	14 days
GEOTECHNICAL AND PHYSICAL PROPERTIES											
Grain Size	River Sediment	6	--	--	--	--	ASTM D422	8 oz. glass	8 oz	None	None
Moisture Content			--	--	--	--	ASTM D2216	8 oz. glass	N/A	None	None
Total Organic Carbon			--	--	--	--	ASTM D-2974	8 oz. glass	100 grams	None	None
BTU Content	DNAPL Samples	2	--	--	--	--	ASTM D240	Amber glass	1 liter	None	None
Interfacial tension			--	--	--	--	ASTM D971	Amber glass	100 ml	None	None
Specific Gravity			--	--	--	--	ASTM D1298	Amber glass	100 ml	None	None
Total Organic Halogens			--	--	--	--	SW846 9020	Amber glass	100 ml	4°C	28 days
Viscosity			--	--	--	--	ASTM D445	Amber glass	100 ml	None	None
Water Content			--	--	--	--	Karl Fisher	Amber glass	100 ml	None	None

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Matrix Sample Summary			QA Sample Frequency				Analytical Requirements Summary				
Analytical Parameter <sup>(1)</sup>	Sample Matrix <sup>(2)</sup>	Estimated No. of Samples	Field Duplicates	Equipment Blanks <sup>(3)</sup>	MS/MSDs	Trip Blanks	Method Reference <sup>(4)</sup>	Bottle Type	Required Sample Volume <sup>(5)</sup>	Preservation	Holding Time
GEOTECHNICAL AND PHYSICAL PROPERTIES (CONTINUED)											
BTU Content	Lagoon Solids	10	--	--	--	--	ASTM D240	Amber glass	1 liter	None	None
Atterberg Limits	Barrier Wall Soil Borings and Geotechnical Borings GT-5 Through GT-7	69	--	--	--	--	ASTM D4318	Shelby tube or 8 oz. glass	50 g	None	None
Bulk Density			--	--	--	--	N/A (std. laboratory method)	Shelby tube	N/A	None	None
Consolidation (1 dimensional)			--	--	--	--	ASTM D2435	Shelby tube	N/A	None	None
Gradation			--	--	--	--	ASTM C136	Shelby tube or 8 oz. glass	N/A	None	None
Hydrometer Analysis			--	--	--	--	ASTM D422	Shelby tube or 8 oz. glass	8 oz	None	None
Moisture Content			--	--	--	--	ASTM D2216	Shelby tube or 8 oz. glass	N/A	None	None
Permeability			--	--	--	--	ASTM D5084	Shelby tube	N/A	None	None
Specific Gravity			--	--	--	--	ASTM D854	Shelby tube or 8 oz. glass	8 oz	None	None
Triaxial Shear (3 points each)			--	--	--	--	ASTM D4767	Shelby tube	N/A	None	None
USCS Classification			--	--	--	--	ASTM D2487	Shelby tube or 8 oz. glass	N/A	None	None
Gradation	DNAPL System Soil Borings DS-1 through DS-6 (Fill and Deeper Sand Units)	12	--	--	--	--	ASTM C136	Shelby tube or 8 oz. glass	N/A	None	None
Hydrometer Analysis			--	--	--	--	ASTM D422	Shelby tube or 8 oz. glass	8 oz	None	None
USCS Classification			--	--	--	--	ASTM D2487	Shelby tube or 8 oz. glass	N/A	None	None
Atterberg Limits	Geotechnical Borings GT-1 through GT-4 (Meadow Mat)	4	--	--	--	--	ASTM D4318	Shelby tube or 8 oz. glass	50 g	None	None
Moisture Content			--	--	--	--	ASTM D2216	Shelby tube or 8 oz. glass	N/A	None	None
Gradation			--	--	--	--	ASTM C136	Shelby tube or 8 oz. glass	N/A	None	None
Hydrometer Analysis			--	--	--	--	ASTM D422	Shelby tube or 8 oz. glass	8 oz	None	None
Triaxial Shear (3 points each)			--	--	--	--	ASTM D4767	Shelby tube	N/A	None	None
Gradation	Geotechnical Borings GT-3 and GT-4 (Fill and Deeper Sand Units)	4	--	--	--	--	ASTM C136	Shelby tube or 8 oz. glass	N/A	None	None
Hydrometer Analysis			--	--	--	--	ASTM D422	Shelby tube or 8 oz. glass	8 oz	None	None
USCS Classification			--	--	--	--	ASTM D2487	Shelby tube or 8 oz. glass	N/A	None	None



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SCCC AND DIAMOND SITES  
KEARNY, NEW JERSEY

Matrix Sample Summary			QA Sample Frequency				Analytical Requirements Summary				
Analytical Parameter <sup>(1)</sup>	Sample Matrix <sup>(2)</sup>	Estimated No. of Samples	Field Duplicates	Equipment Blanks <sup>(3)</sup>	MS/MSDs	Trip Blanks	Method Reference <sup>(4)</sup>	Bottle Type	Required Sample Volume <sup>(5)</sup>	Preservation	Holding Time
GENERAL WATER QUALITY PARAMETERS											
Alkalinity	Ground Water	24	--	--	--	--	EPA 310.1	Plastic or glass	100 ml	4°C	14 days
Biochemical Oxygen Demand			--	--	--	--	EPA 405.1	Plastic or glass	1000 ml	4°C	48 hours
Chemical Oxygen Demand			--	--	--	--	EPA 410.1	Plastic or glass	100 ml	H <sub>2</sub> SO <sub>4</sub> to pH<2; 4°C	28 days
Oil and Grease			--	--	--	--	SW846 9070	Glass	1000 ml	H <sub>2</sub> SO <sub>4</sub> to pH<2; 4°C	28 days
Total Dissolved Solids			--	--	--	--	EPA 160.1	Plastic	100 ml	4°C	7 days
Total Organic Carbon			--	--	--	--	EPA 415.1	Plastic or glass	100 ml	H <sub>2</sub> SO <sub>4</sub> to pH<2; 4°C	28 days
Total Suspended Solids			--	--	--	--	EPA 160.2	Plastic	100 ml	4°C	7 days
Total Dissolved Solids	Lagoon Storm Water	4	--	--	--	--	EPA 160.1	Plastic	100 ml	4°C	7 days
Total Suspended Solids			--	--	--	--	EPA 160.2	Plastic	100 ml	4°C	7 days
GENERAL WATER QUALITY FIELD PARAMETERS											
Hydronium Ion (pH)	Ground Water	24	--	--	--	--	--	--	--	--	--
Oxidation-Reduction Potential			--	--	--	--	--	--	--	--	--
Specific Conductance			--	--	--	--	--	--	--	--	--
Temperature			--	--	--	--	--	--	--	--	--
Turbidity			--	--	--	--	--	--	--	--	--
Water Levels			--	--	--	--	--	--	--	--	--
DNAPL Thickness			--	--	--	--	--	--	--	--	--
Hydronium Ion (pH)	Lagoon Storm Water	4	--	--	--	--	--	--	--	--	--
Oxidation-Reduction Potential			--	--	--	--	--	--	--	--	--
Specific Conductance			--	--	--	--	--	--	--	--	--
Temperature			--	--	--	--	--	--	--	--	--
Turbidity			--	--	--	--	--	--	--	--	--

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SCCC AND DIAMOND SITES  
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Matrix Sample Summary			QA Sample Frequency				Analytical Requirements Summary				
Analytical Parameter <sup>(1)</sup>	Sample Matrix <sup>(2)</sup>	Estimated No. of Samples	Field Duplicates	Equipment Blanks <sup>(3)</sup>	MS/MSDs	Trip Blanks	Method Reference <sup>(4)</sup>	Bottle Type	Required Sample Volume <sup>(5)</sup>	Preservation	Holding Time
RCRA CHARACTERIZATION											
Corrosivity	Soil	60	--	--	--	--	SW846 9045C	Glass	20 g	None	Analyze immediately
	River and South Ditch Sediment	11	--	--	--	--	SW846 9045C	Glass	20 g	None	Analyze immediately
	Lagoon Solids	10	--	--	--	--	SW846 9045C	Glass	20 g	None	Analyze immediately
	DNAPL	2	--	--	--	--	SW846 9045C	Glass	20 g	None	Analyze immediately
Ignitability	Soil	60	--	--	--	--	SW846 1010A	Not specified	Not specified	Not specified	Not specifed
	River and South Ditch Sediment	11	--	--	--	--	SW846 1010A	Not specified	Not specified	Not specified	Not specifed
	Lagoon Solids	10	--	--	--	--	SW846 1010A	Not specified	Not specified	Not specified	Not specifed
	DNAPL	2	--	--	--	--	SW846 1010A	Not specified	Not specified	Not specified	Not specifed
Reactivity	Soil	60	--	--	--	--	SW846 9030A	Not specified	Not specified	Not specified	Not specifed
	River and South Ditch Sediment	11	--	--	--	--	SW846 9030A	Not specified	Not specified	Not specified	Not specifed
	Lagoon Solids	10	--	--	--	--	SW846 9030A	Not specified	Not specified	Not specified	Not specifed
	DNAPL	2	--	--	--	--	SW846 9030A	Not specified	Not specified	Not specified	Not specifed
TCLP VOCs SVOCs & Metals	Soil	60	--	--	--	--	SW846 1311 SW846 8260B SW846 8270C SW846 6010B SW846 7470A	Glass	500 mg	4°C	VOCs: 14 days to ext/14 days to analysis; SVOCs: 14 days to ext/7 days to prep/40 days to analysis; metals: 6 months to ext/6 months to analysis; mercury: 28 days to ext/28 days to analysis
	River and South Ditch Sediment	11	--	--	--	--	SW846 1311 SW846 8260B SW846 8270C SW846 6010B SW846 7470A	Glass	500 mg	4°C	VOCs: 14 days to ext/14 days to analysis; SVOCs: 14 days to ext/7 days to prep/40 days to analysis; metals: 6 months to ext/6 months to analysis; mercury: 28 days to ext/28 days to analysis
	Lagoon Solids	10	--	--	--	--	SW846 1311 SW846 8260B SW846 8270C SW846 6010B SW846 7470A	Glass	500 mg	4°C	VOCs: 14 days to ext/14 days to analysis; SVOCs: 14 days to ext/7 days to prep/40 days to analysis; metals: 6 months to ext/6 months to analysis; mercury: 28 days to ext/28 days to analysis
	DNAPL	2	--	--	--	--	SW846 1311 SW846 8260B SW846 8270C SW846 6010B SW846 7470A	Glass	500 mg	4°C	VOCs: 14 days to ext/14 days to analysis; SVOCs: 14 days to ext/7 days to prep/40 days to analysis; metals: 6 months to ext/6 months to analysis; mercury: 28 days to ext/28 days to analysis

TABLE 2  
QUALITY CONTROL SAMPLE, ANALYTICAL METHOD, SAMPLE CONTAINER, PRESERVATION, AND HOLDING TIME REQUIREMENTS  
SCCC AND DIAMOND SITES  
KEARNY, NEW JERSEY

1. Abbreviations for analytical parameters are as follows:

BTU -	British Thermal Units
PCBs -	Polychlorinated Biphenyls
PCDD -	Polychlorinated Dibenzodioxins
PCDF -	Polychlorinated Dibenzofurans
SVOCs	Semivolatile Organic Compounds
TAL -	Target Analyte List
TCL -	Target Compound List
TCLP -	Toxicity Characteristic Leaching Procedure
USCS -	Unified Soil Classification System
VOCs -	Volatile Organic Compounds

2. Abbreviations for sample matrices are as follows:

DNAPL -	Dense Non-Aqueous Phase Liquid
---------	--------------------------------

3. For samples collected using decontaminated equipment that is reused, equipment blanks will be collected at a rate of one per day. For samples collected using dedicated or single-use disposable equipment, equipment blanks will be collected at a rate of one per sampling event.

4. Abbreviations for analytical methods are as follows:

ASTM -	American Society for Testing and Materials
EPA -	Environmental Protection Agency methods per <u>Methods for Chemical Analysis of Water and Wastes</u> . (EPA 600/4-70-020)
SW846 -	Environmental Protection Agency methods per <u>Test Methods for Evaluating Solid Waste - Physical/Chemical Methods - SW846 (3rd Ed)</u> . (as revised and updated)

5. Precleaned and prepreserved sample bottles to be provided by the laboratory. Sample volumes to be minimized as possible based on minimum laboratory volume requirements.

**ATTACHMENT A**

**KEY STANDARD OPERATING PROCEDURE #155**

**IS ELECTRONIC DATA DELIVERABLES**

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## **SOP 155 -GIS ELECTRONIC DATA DELIVERABLES**

### **1.0 SCOPE AND PURPOSE**

This Standard Operating Procedure (SOP) specifies the formatting requirements for the submission of electronic laboratory analytical data.

Attached is the file layout structure for the "Labdata. dbf" file as utilized by GIS/Key's™ Winbuild module. The file may be submitted as a dBase (.dbf) or an Excel (.xls) file.

Files should be submitted initially via e-mail, with a diskette of the deliverable mailed to Key Environmental, Inc.'s Pittsburgh office.

If laboratory personnel have any questions regarding this format, they should direct their inquiries to Key Environmental, Inc.'s GIS coordinator. A template of the labdata format is available upon request from Key Environmental, Inc

**FILE LAYOUT FOR ELECTRONIC DOWN LOAD TO GIS/KEY**

Remark	Required	Justify	Field Name 10 Character	Type	Len	Dec	Notes (Default parameters)
user	X *	L	SITE_ID	C	15		Well or sampling location as labeled on the GIS\Key Map. An entry in SITE_ID is required for all Primary results, duplicates, and splits. Spike results may be associated with samples from another location, and therefore SITE_ID is not required although recommended if appropriate. The import routine requires all sites to be in the project database.
user	X *	L	SP_ID	C	7		Sample Period (EVENT_ID) is used to group QA/QC data to within the data range of the sample period. An entry in the EVENT_ID field is required for Blanks, Control Samples and Spikes. The import routine requires the EVENT_ID to be defined in the project database.
lab	X		SAMP_TYPE	C	1		Sample types are <W>ater, <S>oil, Sediment, Solid. Others sample types can be added, but these are not supported by GIS\Key. The import routine requires < W, S> entry.
lab	X	L	RES_CODE	C	4		Preliminary code used to determine the type of chemical result. See notes at end of table for details of valid entries. RES_CODE is used by the GIS/Build routine to derive the GIS\Key RES_TYPE and RES_CLASS fields. Initially assigned by the lab and modified as required by the user to reflect sample status not known by the lab.
GIS	internal		RES_CLASS	C	1		Assigned by GIS/Build from the RES_CODE field, this code refers to the type of result received from the lab. Allowable RES_CLASS entries are <P>rimary/duplicate/split <C>ontrol sample <B>lank sample  and <S>pike sample.
GIS	internal	L	RES_TYPE	C	3		Assigned by GIS/Build from the RES_CODE field, this code works in conjunction with RES_CLASS to describe the type of result. It consists of a one character code, a test sequence number, and a result occurrence.
lab			RES_COLUMN	C	1		The column number of a multiple column test. RES_COLUMN should = 0 for the result set of record of a record. This corresponds to a RES_CODE result set occurrence = 0 for the result set of record. For other result sets, the column number of the test should be given. Used primarily for IRPIMS reporting.
lab	X*	L	RES_ORIG	C	3		Points to the originating result of a result set of record in a multiple column or dilution test. A result set of the record may be a combination of one or more column/dilution tests. The RES_ORIG points to the result in the test run from which the result of the record came and should equal the last 3 characters of the RES_CODE for that result. Used primarily for IRPIMS reporting.
lab	X*		SURROG_FLG	L	1		The field is set to "T" for a surrogate result and "F" for all other result types.
user	X	L	SAMP_ID	C	15		SAMP_ID is the unique identifier provided to the laboratory on the sample bottle.
user		L	SAMP_ID2	C	15		SAMP_ID2 is used ONLY for Field Spike Duplicates or for Blind Control Sample Duplicates.

**FILE LAYOUT FOR ELECTRONIC DOWN LOAD TO GIS/KEY**

Remark	Required	Justify	Field Name 10 Character	Type	Len	Dec	Notes (Default parameters)
user	X *		SAMP_DATE	D	8		Date sample was collected (mm/dd/yy format). Required for all results except blanks, spikes and control samples.
lab/user	X *		SAMP_TIME	C	5		Time sample was collected (##:## 24hr format). Required for all primary, duplicate, split and surrogate results but not required for blank, spike, and control sample results. If not required and not specified, the import routine enters a default of 00:00.
user	X *		SAMP_DEPTH	N	8		Depth below ground surface in meters (metric) or feet (American) at which sample was collected. Required for SAMP_TYPE = <S>, Recommended for SAMP_TYPE = <W>. Depths above ground surface are assigned a negative number. Note that primary key in American version is based on depth measurements to a hundredth of a foot only.
user			S_DEPTH	N	8	3	Depth below ground surface in feet to the top of the sample interval range.
user			E_DEPTH	N	8	3	Depth below ground surface in feet to the bottom of the sample interval range.
user	X *	L	CASE_ID	C	5		Case and blank Ids or case and QA/QC IDs are used to associate primary results with quality control results. CASE_ID is a required entry for quality control data and should be entered for primary results if quality control data is being entered. For small projects, many GIS\Key users use sampling event as CASE_ID. IRPIMS projects should enter the IRPIMS site in the CASE_ID.
lab/user	X*	L	SDG_ID	C	25		SDG or sample delivery group ID. This field (in combination with CASE_ID) is used to associate rinsate blank results with primary results. Required for rinsate blanks.
lab	X*	L	QAQC_ID	C	25		QA/QC Batch ID's are normally assigned only by labs. This field is used to associate laboratory quality control results (i.e. method blanks, lab blanks, matrix spikes, control samples) with primary results. QAQC_ID entries must uniquely identify each batch of samples analyzed by the laboratory and may not be repeated. Required for method blanks.
lab/ user	X*	L	BLANK_ID	C	25		Field Blank identifier. BLANK_ID is used in combination with CASE_ID to associate field blank results with primary results. Required for field blanks.
user	X	L	TCL_ID	C	10		TCL ID, or Template Constituent List is required for all results. A TCL is a data entry template which groups sample results into logical sets. The user defines a TCL to include a lab code (LAB_ID) and optionally a test method (METHOD_ID) and a list of chemicals with reporting limits. GIS/Build can automatically assign a TCL, if METHOD_ID and LAB_ID are provided.
GIS/ user	X		TCL_TYPE	C	1		TCL Type. Used to differentiate lists of chemicals having the same test method and lab. GIS/Build assigns the GIS/Key default value to this field if it is left blank.
lab/user		L	METHOD_ID	C	10		Test Method identification. The import routine will generate error messages if the METHOD_ID is not in the GIS\Key database.

**FILE LAYOUT FOR ELECTRONIC DOWN LOAD TO GIS/KEY**

Remark	Required	Justify	Field Name 10 Character	Type	Len	Dec	Notes (Default parameters)
lab	X*	L	EXTRACTION	C	6		Extraction method code. The import routine requires definition of entries in the GIS/Key database.
user		L	LAB_ID	C	5		Lab ID code. The Import routine requires codes to be defined in GIS\Key database. Lab ID codes must be incorporated into the definition of a TCL_ID.
GIS	internal	R	SEQ_NUM	C	3		Used to order the compounds in a TCL (SEQ_NUM=1 for the first compound on a TCL). When editing results after data import, the sequence number controls the order in which the results are viewed. GIS/Build assigns a SEQ_NUM based on the SEQ_NUM of the chemicals defined in the TCL. If a TCL definition is not found in the project, the SEQ_NUM assignment is based on the order within the TCL in LABDATA.dbf.
user	X *	L	SPLIT_ID	C	10		SPLIT_ID records the TCL_ID of the first split sample of the primary sample. This field is left blank unless the record is for a primary result and a split sample was analyzed. A split sample result entered as a separate record will be orphaned unless this field is filled in for the primary result record.
user	X *	L	SPLIT_ID2	C	10		SPLIT_ID2 records the TCL_ID of the second split sample of the primary sample. This field is left blank unless the record is for a primary result and a second split sample was analyzed. The second split result, entered as a separate record, will be orphaned unless this field is filled in for the primary result record.
lab	X*	L	LSAMP_ID	C	15		Lab sample ID.
lab		L	LSAMP_ID2	C	15		ab sample ID of duplicates, entered by the lab for known-control sample duplicates and lab spike duplicates.
lab	X *	R	LAB_CAS_ID	C	11		CAS Registry number assigned by the Lab for the constituent. Either a LAB_CAS_ID or a LAB_CHEM must be included with each record. The import routine requires any LAB_CAS_ID to match a CAS_NUM in GIS\Key COMPOUND.DBF.
GIS	internal	R	CAS_NUM	C	11		CAS number from the GIS\Key compound.dbf. This is internally assigned based on a match with LAB_CHEM or LAB_CAS_ID, with preference given to LAB_CAS_ID
lab	X *	L	LAB_CHEM	C	40		Constituent name from lab. Either a LAB_CAS_ID or a LAB_CHEM must be included with each result. If LAB_CHEM is used, then it must match a GIS\Key COMPOUND.DBF alias.
GIS	internal	L	NAME	C	40		Constituent name assigned by comparing LAB_CHEM to COMPOUND.DBF. If LAB_CAS_ID is used without a matching LAB_CHEM, NAME is assigned based on alias 0 in GIS\Key Database.
GIS	internal	R	ALIAS_NUM	C	2		Alias numbers are internally assigned by comparing LAB_CAS_ID and LAB_CHEM to COMPOUND.DBF.



**FILE LAYOUT FOR ELECTRONIC DOWN LOAD TO GIS/KEY**

Remark	Required	Justify	Field Name 10 Character	Type	Len	Dec	Notes (Default parameters)
lab	X *	L	CONC	C	11		Utilized to store constituent concentrations for primary results, duplicates, splits & blanks and concentrations added to spikes and control samples. The field is left blank for surrogates. Warning code generated when CONC and LIMIT1 are both left blank for primary results, duplicates, splits and blanks. Stored as a character string to preserve significant figures. May be expressed in scientific notation (e.g. 1.3E03). All entries must be numeric with the exception of "E" (i.e. scientific notation), "+", or a "+/-". A "+" after concentration amount means greater than while a concentration followed by "+/-" and a number expresses an uncertainty factor.
lab	X *	L	LIMIT1	C	10		Detection Limit 1 for a sample result. Stored as a character string to preserve the significant figures. May be expressed in scientific notation (e.g. 1.3E03). Required for primary results, duplicates, splits & blanks if CONC is blank. Left blank for control samples, matrix spikes and surrogates. All entries must be numeric with the exception of "E" (i.e. scientific notation) or "?". A "?" means that the detection limit is unknown. The entered detection limit should reflect dilution. Generally, LIMIT1 refers to the method detection limit. However, GIS\Key places no restrictions on the use of this field.
lab	X *	L	DL_FLAG	C	2		Place a {<} in this field if the result is non-detect, otherwise leave it blank. Required for primary results, duplicates, splits and blanks. The field is left blank for control samples, matrix spikes and surrogates. For IRPIMS files, DL_FLAG corresponds to the PARVQ field. DL_FLAG corresponds to RF_FLAG on the data entry screen.
lab	X *	L	UNITS	C	5		Reported units of concentration. GIS\Key can automatically convert concentrations in mg/l, mg/kg, ug/l, ug/kg, ppm, ppb, and %. Other units are allowed but will generate warning codes.
lab		L	LIMIT2	C	10		Practical quantitation limit for a blank or primary sample result. Format limitations for LIMIT2 are the same as described for LIMIT1. The entered quantitation limit should reflect dilution. GIS\Key places no restrictions on the use of this field.
lab		L	INSTRUMENT	C	20		Identifying number or name of laboratory equipment used to perform the analysis. Used primarily for Air Force reporting.
lab		L	CALIBRATE	C	20		Calibration reference number for the test. Used primarily for Air Force reporting.
GIS	internal		SPIKE_DUP	L	1		Flag indicating a spike control sample duplicate record. Information is combined in the same record as the spike or control sample.
lab/ user		L	TEST_ORIG	C	3		Used for spikes to identify the res_code of the sample that was spiked.
lab			S_CONC	C	11		Spike Concentration
lab	X *		RECOVER	N	3		Constituent Recovery in %. Required for spike, surrogate, and control sample results. The field is left blank for primary samples, duplicates, splits and blanks. Supplied by the Lab for surrogates, lab matrix spikes and known control samples.

**FILE LAYOUT FOR ELECTRONIC DOWN LOAD TO GIS/KEY**

Remark	Required	Justify	Field Name 10 Character	Type	Len	Dec	Notes (Default parameters)
lab	X *		D_RECOVER	N	3		Duplicate constituent recovery in %. Required for spike and control sample duplicates results. The field is left blank for primary sample, duplicates, splits, blanks, and surrogates. Supplied by the Lab for lab matrix spikes and known control samples.
lab/user		L	T_CONC	C	11		Target concentration for spikes (i.e. calculated total of concentration in sample plus concentration spiked).
lab		L	R_CONC	C	11		Measured concentration in control samples and spiked samples. Supplied by the Lab for lab matrix spikes, field matrix spikes, blind control samples and known control samples.
lab		L	D_CONC	C	11		Measured concentration in duplicate control samples and spiked samples. Supplied by the Lab for lab matrix spikes, field matrix spikes, blind control samples, and known control samples.
lab			RPD	N	3		Relative Percent Difference (RPD). Supplied by the Lab for matrix spike and control samples that are run in duplicate. When RES_CODES DL#/DF#/DB#/DK# are used, the RPD is entered with these records.
lab			B_RECOVER	N	3		Lower percent recovery goal for surrogates, spikes, and control samples and spikes reported by the Laboratory.
lab			E_RECOVER	N	3		Upper percent recovery goal for surrogates, spikes, and control samples reported by the Laboratory.
lab			MAX_RPD	N	3		Maximum relative percent difference goal for control samples and spikes reported by the Laboratory.
lab/user	X		PF_CODE	C	1		Preparation Fraction Code: The import routine requires the preparation fraction to be specified and to match a user-defined code in GIS\Key database, standard codes include "T" (total), "D" (dissolved fraction), "A": Acid Rain Extraction, "C" TCLP Extraction, "E" EPTOX Extraction, "S": California Wet Extraction, "W": Deionized Water Extraction.
lab			CR_C	C	1		CLP data concentration "C" column. The import routine requires entry to match a code defined in GIS\Key Database.
lab		L	CR_M	C	2		CLP data method "M" column. The import routine requires entry to match a code defined in GIS\Key Database.
lab		L	CR_Q	C	3		CLP data qualifier "Q" column. The import routine requires entry(s) to match 1 character code(s) defined in the GIS\Key Database.
user		L	ER_Q	C	3		Expert review data qualifier. The import routine requires entry(s) to match 1 character code(s) defined in the GIS\Key Database.
user		L	ER_R1	C	2		Expert review reason 1 "R1" code. The import routine requires entry to match a defined code in GIS\Key Database.
user		L	ER_R2	C	2		Expert review reason 2 "R2" code. The import routine requires entry to match a defined code in GIS\Key Database.
user		L	ER_R3	C	2		Expert review reason 3 "R3" code. The suggested use of this field is to track updates. The import routine requires entry to match a defined code in GIS\Key Database.

**FILE LAYOUT FOR ELECTRONIC DOWN LOAD TO GIS/KEY**

Remark	Required	Justify	Field Name 10 Character	Type	Len	Dec	Notes (Default parameters)
user			FILTERED	C	1		Was sample field filtered, <Y>es or <N>o. It is the user's responsibility to ensure that preparation fraction codes reflect field filtering status.
user			PRESERVED	C	1		Sample preservation code, "H" = HCl, "N" = HNO <sub>3</sub> , "S" = H <sub>2</sub> SO <sub>4</sub> , "U" = unknown, "" = none, and "O" = other sample preservation code.
user			ICED	C	1		Field preservation Code, "Y" = stored/shipped on ice, "N" = stored/shipped at ambient temperature.
lab	*	L	CUSTODY	C	25		Chain of custody ID. Used to associate travel blanks with primary samples. Required for travel blanks.
lab	*		DILUTION	N	7	2	Dilution factor for sample run ranging from 0.01 to 9999. A required field for all primary results, duplicates, splits and blank results. The field is left blank for all other results.
GIS/user	X*		PROG_TYPE	C	1		Program codes are required for all results. The import routine requires codes to be defined in GIS\Key Database. Program codes must be identical for all chemical results for a particular TCL. GIS/Build assigns the GIS/Key default value to this field if it is left blank.
lab			RECEIVED	D	8		Date sample was received by the Lab (mm/dd/yy format).
lab			REC_TIME	C	5		Time sample was received by the Lab (##:## 24hr format).
lab			PREPARED	D	8		Date sample was prepared or extracted by the Lab (mm/dd/yy format ).
lab			PREP_TIME	C	5		Time sample was prepared or extracted by the Lab (##:## 24hr format).
lab			TESTED	D	8		Date sample was analyzed by the Lab (mm/dd/yy format for American Version).
lab			TEST_TIME	C	5		Time sample was analyzed by the Lab (##:## 24hr format).
lab			REPORTED	D	8		Date sample was reported by the Lab (mm/dd/yy format for American Version).
lab			APPROVED	D	8		Date sample was result approved by the Lab (mm/dd/yy format for American Version).
lab/ user		L	LOT_NUMBE R	C	4		IRPIMS lot control number (LOTCTLNUM) used to associate primary samples with QC.
lab/ user		L	SA_CODE	C	3		IRPIMS sample type code (SA_CODE) used to identify the type of sample collected.
lab/ user		L	MATRIX	C	2		IRPIMS sampling matrix code.
lab/ user			BASIS	C	1		Used to indicate whether results are reported on a (W)et or (D)ry basis. Required for soil results.
lab/ user			MOISTURE	N	4	1	Percent moisture of a soil sample.
GIS	internal	L	EXC_CODE	C	30		Exception codes are generated by the import routine to alert the user to problems in the LABDATA.DBF file which must be addressed before the data can be appended to the project database.
GIS	internal	L	WARN_CODE	C	20		Warning codes are generated by the import routine to alert the user to possible problems in LABDATA.DBF file. Warning codes do not prevent user from appending LABDATA.DBF file to the project database.

**FILE LAYOUT FOR ELECTRONIC DOWN LOAD TO GIS/KEY**

Remark	Required	Justify	Field Name 10 Character	Type	Len	Dec	Notes (Default parameters)
GIS	internal		BUILD_FLAG	C	1		Internal flag used during the GIS\Build process.
lab/ user		L	NOTE	C	20		Lab/user notes for samples (i.e. placed in CSAMPLE.DBF). May be expanded to 50 characters.
lab/user		L	TEST_NOTE	C	20		Lab/user notes for tests (i.e. placed in CTEST.DBF). May be expanded to 50 characters.

Notes appear on the following pages.

## FILE LAYOUT FOR ELECTRONIC DOWN LOAD TO GIS/KEY

### Notes:

#### RES CODES:

PP0<1-9>	Primary Results
PD[1-9]<1-9>	Duplicate
PS[1-2]<1-9>	Split
BF[1-9]<1-9>	Field Blanks
BL[1-9]<1-9>	Lab Blanks
BM[1-9]<1-9>	Method Blanks
BR[1-9]<1-9>	Rinsate Blanks
BT[1-9]<1-9>	Travel Blanks
CB[1-9]<1-9>	Blind Control Sample
CK[1-9]<1-9>	Known Control Sample
SL[1-9]<1-9>	Lab Spike
SF[1-9]<1-9>	Field Spike
DL[1-9]<1-9>	Duplicate Lab Spike
DF[1-9]<1-9>	Duplicate Field Spike
DB[1-9]<1-9>	Duplicate Blind Control Sample
DK[1-9]<1-9>	Duplicate Known Control Sample

Numbers in [] denote test sequence numbers

Numbers in <> denote result set occurrence

\* = Conditionally Required

#### EXCEPTION CODES: (an exc\_code indicates bad or missing data)

AN =	No entry in ALIAS_NUM
BI=	No entry in BLANK_ID (for a field blank)
CI=	No entry in CASE_ID
CN=	Cas Number is not found in COMPOUND.DBF
CU=	No entry in CUSTODY (for a trip blank)
DI=	DILUTION <= 0
DP=	Sample depth precision > 2 (not allowed for American or unspecified project)
DR=	Duplicate record
HT=	Holding times out of sequence (SAMP_DATE, RECEIVED, PREPARED, TESTED and REPORTED)
LB=	No entry in LAB_ID
PF=	Invalid in PF_CODE
PS=	No primary sample for duplicate or split
PT =	Invalid in PROG_TYPE
QC =	No entry in QAQC_ID (for a lab blank, method blank, spike or control sample)
RC=	Invalid RES_CODE
SD=	No entry in SAMP_DATE
SG=	No entry in SDG_ID (for a rinsate blank)
SI=	No entry in SITE_ID
SP=	No entry in SP_ID(event) or 3rd character of id is not a '.'
SK=	No spike duplicate match or invalid spike dup fields
ST=	Invalid SAMP_TYPE
TC=	No entry in TCL_ID
TM=	SAMP_TIME format invalid

#### WARNING CODES:

BA	=	BASIS should be 'W'et or 'D'ry for soil results
CI	=	No entry in case id for a primary sample
DL	=	No detection limit and no conc
DP	=	Sample Depth = 0 or not within range of S_DEPTH & E_DEPTH
PF	=	PF_CODE not defined in project
PS	=	No primary sample for duplicate or split
PT	=	PROG_TYPE not defined in project
SD	=	No entry in sample date for a rinsate or field blank
RE	=	B_RECOVER > E_RECOVER
TM	=	Invalid TEST_TIME for rinsate or lab blank
TT	=	TCL_TYPE not defined in project
U	=	No entry in UNITS

## FILE LAYOUT FOR ELECTRONIC DOWN LOAD TO GIS/KEY

### Notes (continued):

DUPLICATE RECORD KEY FOR PRIMARIES, DUPLICATES AND SPLITS (RES\_CODE = PP0#, PD##, PS##):

SAMP\_TYPE + SITE\_ID + SAMP\_DATE + SAMP\_TIME(water) or SAMP\_DEPTH(soil) + RES\_CODE + TCL\_ID + PF\_CODE + CAS\_NUM

Index file = EXPRI.IDX                      TO use in FOXPRO enter: USE EXCDATA INDEX EXCPRI

DUPLICATE RECORD KEY FOR BLANKS (RES\_CODE = BR##, BM##, BT##, BF##):

SAMP\_TYPE + CASE\_ID + BLANK\_ID + RES\_CODE + TCL\_ID + PF\_CODE + CAS\_NUM

Index file = EXCQC.IDX                      TO use in FOXPRO enter: USE EXCDATA INDEX EXCQC

DUPLICATE RECORD KEY FOR SPIKES AND CONTROL SAMPLES (RES\_CODE = SF##, SL##, CB##, CK##):

SAMP\_TYPE + CASE\_ID + QAQC\_ID + RES\_CODE + TCL\_ID + PF\_CODE + CAS\_NUM

Index file = EXCQC.IDX

### ASSIGNING RES\_CODE SEQUENCE NUMBERS [1-9]:

The test sequence number refers to a sample sequence used to differentiate test results that otherwise have the same primary key. For example, a test sequence number of 2 for a duplicate sample would mean that the result set is for the second of 2 duplicate samples originating from the same primary sample. A test sequence number of 2 for a method blank would mean that 2 method blanks were run for the same batch (QAQC\_ID). Note that matrix spikes and control samples and their duplicates should always have matching test sequence numbers.

### ASSIGNING RES\_CODE RESULT SET OCCURRENCES <1-9>:

The result set occurrence is used to differentiate multiple column or dilution runs of the same sample and test method that otherwise have the same primary key. Occurrence = 1 is the set of record and the set used for reporting and graphics.

### ASSIGNING RES\_ORIG CODES

RES\_ORIG codes are equal to the last three characters of RES\_CODES for all results except when multiple column/dilution runs are being reported and the result being reported is for the combined "best estimate" result. In this case, the RES\_ORIG code equals the last three characters of the RES\_CODE of the originating column/dilution run.

### ADDITIONAL GUIDANCE FOR FIELD/LAB MATRIX SPIKE DUPLICATES AND BLIND/KNOWN CONTROL SAMPLE DUPLICATES:

Field/lab matrix spike duplicate and blind/known control sample duplicate concentrations are always entered in the D\_CONC field, with recoveries in the D\_RECOVER field. Spike and control sample duplicates may be entered as individual records using RES\_CODES DL##, DF##, DB##, DK##, or can be combined with the record storing the original spike or control sample when using RES\_CODES SL##, SF##, CB##, CK##.

## **APPENDIX E**

### **FIELD SAMPLING PLAN**

**INTERIM RESPONSE ACTION WORKPLAN  
FIELD SAMPLING PLAN**

**STANDARD CHLORINE CHEMICAL COMPANY SITE  
AND FORMER DIAMOND SITE  
KEARNY, NEW JERSEY**

*Prepared for:*

**The Peninsula Restoration Group  
(Standard Chlorine Chemical Company, Tierra Solutions, Inc.  
and Beazer East, Inc.)**

*Prepared by:*

**Key Environmental, Inc.**  
200 Third Avenue  
Carnegie, Pennsylvania 15106

**May 2007**



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## **LIST OF ATTACHMENTS**

### Attachment A – SOPs

- SOP No. 101 – Sediment Sampling  
SOP No. 103 – Environmental Sample Preparation  
SOP No. 105 – Chain of Custody  
SOP No. 106 – Field Logbook  
SOP No. 107 – Subsurface Soil Sampling  
SOP No. 109 – Groundwater Level Measurements  
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SOP No. 122 – Management of Investigation Derived Wastes  
SOP No. 123 – Monitoring Well Construction in Unconsolidated Formations  
SOP No. 124 – Surface Water Sampling  
SOP No. 146 – Photo Ionization Detectors  
SOP No. 154 – DNAPL Sample Collection

## **1.0 INTRODUCTION**

### **1.1 STATEMENT OF PURPOSE**

This document has been prepared by Key Environmental, Inc. (KEY) on behalf of the Peninsula Restoration Group (“Group”) to present a Field Sampling Plan (FSP) for the Standard Chlorine Chemical Company (SCCC) Site and the adjoining former Diamond Shamrock (Diamond) Site located in Kearny, New Jersey. Figure 1-1 provides a location map for the two sites. The Group is comprised of SCCC, Tierra Solutions, Inc. (Tierra) [the current owner of the Diamond Site], and Beazer East, Inc. (Beazer) [a former owner of the SCCC Site].

This FSP is a component of the overall Interim Response Action Workplan for the SCCC and Diamond Sites. The IRAW describes the interim remedies proposed by the Group for the SCCC and Diamond Sites including a barrier wall system, a hydraulic control system, a Dense Non-Aqueous Phase Liquid (DNAPL) recovery system, lagoon dewatering and backfilling, near-shore sediment management, an interim surface cover and storm water management system, and various site preparation activities. This FSP presents the field procedures and data acquisition methods necessary for execution of the IRAW.

The FSP was prepared to be consistent with the applicable components of the New Jersey Department of Environmental Protection (NJDEP) Field Sampling Procedures Manual (FSPM) dated August 2005, and is complimented by other documents that outline IRAW implementation procedures including the Quality Assurance Project Plan (QAPP), and the Health and Safety Plan (HASp). Many of the procedures presented herein were taken from the *Standard Investigations Procedures Plan (SIPP) for the Remedial Investigation at Chromite Ore Processing Residue Site 116 (Standard Chlorine) Kearny, New Jersey* which was prepared on behalf of Tierra. Applicable KEY Standard Operating Procedures (SOPs) are included in Attachment A and are referenced herein where appropriate. Where a discrepancy exists between an SOP and specific protocol included in this FSP, the procedure specified in the main body of the FSP takes precedence. Where a discrepancy exists between the FSP and a specific protocol included in the FSPM, the procedure specified in the FSPM takes precedence.

### **1.2 SITE BACKGROUND**

A detailed discussion of Site background information, including Site History, Site Geology, and Site Hydrogeology is provided in Section 2.0 of the IRAW.

### **1.3 DESCRIPTION OF INTERIM REMEDY COMPONENTS**

Sections 1.4 and 3.0 of the IRAW provide descriptions of the various IRA components. The design data acquisition activities will focus on collection of data to support these IRAW components, which consist of the following:

- Barrier Wall System
- Hydraulic Control System
- DNAPL Recovery System
- Lagoon Dewatering and Backfilling
- Near-Shore River Sediment Management
- Interim Surface Cover and Stormwater Management System
- Site Preparation Activities

The plan locations of the major IRA components are shown on Figure 1-2. The design data acquisition procedures outlined in this FSP will focus on collection of data to support the preceding IRA components.

## **2.0 SCOPE OF WORK OVERVIEW**

Section 4.0 of the IRAW provides a detailed description of the design data acquisition activities. The scope of work, identifying the sample collection locations, descriptions, sample matrix, boring depth, sample depth, required analytical suite, sampling method, and intended use of the data is summarized in Table 2-1. Figure 2-1 depicts planned boring and sample locations. Detailed procedures for various aspects for the design data acquisition activities are provided in the remainder of this FSP.

### **3.0 SOIL SAMPLING PROCEDURES**

This section presents the procedures for subsurface soil sampling. Subsurface soil samples will be obtained from borings advanced into the unconsolidated materials at the Site. All drilling activities will be performed by New Jersey-licensed well drillers under the direction of a qualified geologist or engineer. All necessary drilling permits required by N.J.S.A. 58:4A-14 will be obtained. Prior to any intrusive work, underground structures including tanks, septic systems, and utilities will be identified in accordance with KEY SOP No. 121. The remainder of this section discusses the boring operations and sampling procedures in detail.

#### **3.1 PILOT HOLES IN INTERIM REMEDIAL MEASURES (IRM) AREAS**

A number of proposed soil borings are located in areas where IRM coverings have been constructed. IRM coverings at the SCCC and Diamond Site are shown on Figure 3-1 and include the following:

- Paved IRM consisting of a porous geotextile overlain by four (4) to six (6)-inches of coarse aggregate overlain by approximately 4 inches of asphalt,
- Aggregate-Covered IRM consisting of four (4) to six (6)-inches of coarse aggregate overlain by sandwich layer of geotextile-geomembrane-geotextile overlain by four (4) to 12-inches of coarse aggregate,
- Embankment Cover IRM consisting of a geomembrane layer anchored with sand bags and #3 rebar stakes.

Pilot hole procedures are as follows:

- Hand excavate the aggregate to the first layer of geotextile. The diameter of the excavation shall be one (1)-foot larger than the diameter of the auger that will be used for advancing the borehole. If pavement is present, it will be saw cut. Aggregate removed from the excavation will be stockpiled on polyethylene sheeting away from the borehole. The excavated pavement will be collected in bulk containers for disposal off-site.
- Carefully cut each layer of geotextile and/or geomembrane with a utility knife.
- Continue excavation of aggregate until original pavement or soil is reached and stockpile aggregate on a separate polyethylene sheet.

- Drive appropriate size casing (precut to length) six (6)-inches into the ground immediately below IRM covering, if present, using casing driver. This casing will keep the excavated hole open and will serve as a conduit for soil cuttings, thereby keeping potential subsurface contamination from coming in contact with the IRM covering. The casing will also protect the geomembrane and/or geotextile layer.
- Place a four (4)-foot by eight (8)-foot sheet of plywood staging, or a 10 foot x 10 foot 30 mil polyethylene sheeting around the borehole. This staging will keep drill cuttings from contacting the IRM covering.
- Advance borehole using methods outlined in Section 3.2.
- After necessary information and/or samples have been collected, repair IRM using methods outlined in Section 3.4.2 or 3.4.3, as appropriate.

All excavated material shall be stockpiled on polyethylene sheeting away from the borehole, and after the soil boring is abandoned, the IRM covering shall be repaired as appropriate.

### **3.2 DRILLING METHODS**

Drilling methods for subsurface soil sampling are discussed in detail in KEY SOP No. 110 (Attachment A). For soil borings that will not penetrate more than 10 feet into the varved clay unit (Barrier Wall and DNAPL Recovery System borings), small diameter augers (e.g. 3¼ to 4¼-inch internal diameter, ID) will be advanced to the final depth of the boring. Advancement of the augers will be incremental to allow for collection of soil samples using split spoon samplers or Shelby tube samplers as specified in Section 3.3.1 and 3.3.2, respectively.

The soil borings to support the structural steel sheet pile wall stability analysis (i.e., BW-1 through BW-7, GT-2, and GT-5) are planned to penetrate deeper into the varved clay and possibly into the top of the underlying glacial till unit (the total depth of these borings will be approximately 60 feet below ground surface). As such, precautions will be taken to prevent potential cross-contamination into the underlying units. Initially, the borings will be advanced by HSA techniques using small diameter augers to three (3) feet below the top of the varved clay. Soil samples will be collected, inspected for DNAPL presence and described as specified in Section 3.3.1.

If no visual evidence of DNAPL is observed in the soil samples, the drilling will continue using the same techniques to the final depth of the boring. In the event that DNAPL is visually observed, the boring will be reamed with larger diameter augers (8¼-inch ID) to a minimum of three (3) feet below the top of the varved clay. Permanent steel casing (four (4)-inch ID) will be set in the borehole and tremie-grouted in place with a cement-bentonite grout mixture. The grout will be allowed to cure for a minimum of 24 hours before the boring is advanced to its final depth using wash rotary techniques. The wash rotary drilling technique is described in KEY

SOP No. 110. Water will be used as the drilling fluid. The use of drilling mud will only be permitted if it is absolutely necessary to maintain an open borehole.

### **3.3 SUBSURFACE SOIL SAMPLE COLLECTION PROCEDURES**

Subsurface soil sampling will be conducted according to the procedures presented in the following subsections and the applicable procedures specified in KEY SOP No. 107 (Attachment A).

#### **3.3.1 Split Spoon Soil Sample Collection**

Split-spoon samples will be collected in accordance with ASTM Method D1586 for field and laboratory analysis with the following modifications: The sampler will be driven its entire length of 24 inches and a three (3)-inch diameter split-spoon sampler will be used, as necessary to improve sample recovery in coarser materials or where a greater volume of soil is needed for testing purposes. Specific procedures to be followed are as follows:

- Once the boring is advanced to the desired sampling depth using hollow-stem auger drilling procedures, attach split-spoon sampler to the drill rods and lower into borehole. Do not allow sampler to drop onto the soil to be sampled.
- Position the hammer and anvil and attach to the drill rods.
- Mark the drill rods in four successive six (6)-inch increments so that the advance of the sampler under the impact of the hammer may easily be observed for each six (6)-inch increment.
- Rest the weight of the sampler, drill rods and hammer on the bottom of the boring and check to see if the sampler is advanced under the weight of the rods or the weight of the hammer; if so record the advance. If not advancement was observed. Apply a seating blow. If excess cuttings are encountered (not expected, since center plug is to be used), remove sampler from the borehole and spin augers until the excess cuttings are removed.
- Drive the sampler with blows from a 140 pound hammer raised 30 inches and allowed to strike the anvil. Count the number of blows applied in each six (6)-inch increment until one of the following occurs: 1) the sampler is advanced the complete length (24 inches); 2) a total of 50 blows have been applied during any one of the four (4), six (6)-inch increments; or 3) a total of 150 blows have been applied.
- There is no observed advancement of the sampler during the application of 20 successive blows. If any of the three above circumstances occur, "sampler refusal" will be declared for this depth, and recorded as such.



- Record the number of blows required for each six (6)-inch penetration or fraction thereof. The first 6 inches is considered the seating drive. The sum of the second and third six (6) - inches of penetration is considered the "Standard Penetration Resistance" or the "N" value. If the sampler is driven less than 18 inches, the number of blows per completed 6 inches will be recorded on the boring log. If the sampler penetrates the full length under the static weight of the drill rods, this information will be recorded on the boring log.
- Bring the spoon to the surface and open. Immediately after the spoon is opened, the sample will be screened for the presence of VOCs, as described in KEY SOP No. 153 (Attachment A), by scanning the length of the core with a photoionization detector (PID) or a flame ionization detector (FID). The maximum sustained PID/FID reading will be recorded.
- Record the percent recovery or the length of soil sample recovered.
- Describe the soil samples recovered with regard to such characteristics as composition, color, stratification, and other pertinent information, as outlined in KEY SOP No. 119 (Attachment A). The majority of surficial fill material at the Site contains some amount of COPR. COPR has several distinctive features generally not found in natural soil or in manmade fills originating from other sources. To assist in the identification of COPR, the following description is provided: COPR is predominantly reddish in color (due to a high iron oxide concentration), but may exhibit a greenish or yellowish "blush" on the surface where chromium salts have migrated to the surface via capillary action or evapotranspiration, and have been left behind when the water evaporated. The residue is typically coarsely granular, ranging in size from fine to medium sand-size particles to small gravel-sized particles. The granules are also typically rounded and pitted, due to their slag origins (recrystallization of the material in air after processing typically produces rounded and pitted particles).
- The sample will be inspected for the presence of DNAPL. The presence/absence of DNAPL will be recorded according to the following numeric ranking system.
  - 0 – No visual evidence of impact observed
  - 1 – Soil staining or sheen observed
  - 2 – Residual DNAPL present
  - 3 – Free Phase DNAPL present
- Obtain a representative sample for chemical analyses or possible geotechnical testing. If a sample is to be submitted for geotechnical testing, place the sample into a soil

sample jar without distorting the original stratification. If duplicate soil samples are required, sufficient sample should be removed from the spoon to perform mixing for homogeneity, followed by splitting the mixed sample into the designated sample containers. Containers for soil samples retained for possible geotechnical testing should be labeled to identify the site, boring designation, sample depth, the number of blows per six inches, and the testing to be done on the sample.

- Headspace analyses will then be performed by collecting one sample from each split spoon and placing it into a sealable plastic bag or glass jar. The interval of core selected for the headspace sample should be representative the greatest impacted interval as identified by visual inspection and the preliminary VOC scan. The VOC concentration in the container's headspace will then be analyzed with PID or FID after the sample is allowed to equilibrate. Results of the field screening will be documented on a data sheet and field notebook. The soil core will then be retained for potential geotechnical testing.

### **3.3.2 Shelby Tube Sampling**

Undisturbed soil samples for geotechnical testing will be collected with thin-walled (Shelby Tube) samplers in accordance with ASTM Method D1587. The Shelby tube samplers will be used to collect undisturbed samples from cohesive soil units (i.e., meadow mat and varved clay) for geotechnical testing. A minimum of one (1) Shelby tube of the cohesive units (meadow mat and varved clay) will be acquired at each boring location. The Shelby tube sampling procedure is as follows:

- Advance the boring to the desired sampling depth using hollow-stem augers (or wash rotary techniques for deeper borings where steel casing was set to preclude DNAPL migration).
- Use three (3)-inch diameter, 36-inch long thin-walled tube.
- Attach sampler tube to the sampler head and drill rods. Lower sample tube so that the bottom rests on the bottom of the borehole.
- Push the sampler tube with the drive head of the drilling rig (without rotation) with a continuous rapid motion.
- Continue to push until the full length of the tube (less three (3)-inches) has been advanced or until formation resistance does not allow further advancement without damaging the tube. In no case will the length of advance be greater than the sample tube length, less three (3) inches for cuttings.

- Rotate the drill rods to shear the bottom of the sample after pushing is complete.
- Upon retrieval of sample tube, inspect tube for damage and measure total length of sample recovered. Remove disturbed material from top of tube, and re-measure length. Seal the upper end of tube. Remove the bottom one (1) inch of disturbed material from the tube. Seal the tube ends with hot beeswax and cap.
- Label tube with the site location, boring number, and depth at which the sample was taken. Also label sample orientation (e.g., this side up).
- Prepare sample for shipment to the laboratory and place sample in shipping container. Place orientation label on shipping container. Ship sample tubes in an upright position.

### **3.4 BORING ABANDONMENT**

Soil borings that are not completed as monitoring wells will be permanently abandoned by grouting as soon as possible following completion. Borehole plugging will conform to the requirements outlined in N.J.A.C. 7:9-9 including the submittal of appropriate documentation by a certified well sealer, as necessary. The borehole will be backfilled with a cement-bentonite grout mixture emplaced from the bottom of the boring through a tremie pipe (or drill rods) and applying the appropriate surface treatment to repair the IRM covering, if applicable. Soil boring locations will be staked for subsequent surveying to determine the plan location and ground surface elevations of each boring. Specific procedures for borehole abandonment in areas within or outside IRM coverings are set forth in the following subsections.

#### **3.4.1 Boreholes Outside IRM Site Areas**

Soil borings in areas where there have been no IRM coverings will be sealed using the following procedures:

- Prepare grouting material with the following specifications:
  - Eight (8) gallons of potable water
  - Five (5) pounds of bentonite powder
  - 94 pound bag of cement
- Calculate the volume of the borehole based on the bit or auger head diameter plus 10 percent (%), and the boring depth, and determine the volume of grout to be emplaced. Generally, the total mixed volume is the borehole volume plus 20%.
- Mix the grout to be emplaced.

- Record the type and amount of materials used during the mixing operation. Check to verify that the ratios are within specification tolerance.
- Place tremie pipe near bottom of borehole and begin pumping the grout.
- Continue pumping until return circulation of grout is observed.
- Remove surface casing, drilling rods, and/or tremie pipe.
- Completely fill the borehole and clean surface near the borehole. Level the ground to about the pre-existing grade. Add grout or cement as necessary to the area near the borehole.
- Make a follow-up check at each sealed borehole within 7 to 10 days of completion. Document the visit and record any action taken.

#### **3.4.2 Boreholes in Paved IRM Site Areas**

- Grout borehole to original surface, but below IRM covering, using the methods outlined above. Allow 24 hours for cement grout to cure.
- Clean surface around borehole. Remove steel plate and casing.
- Enlarge excavation of IRM surface to a diameter six (6) inches larger than the hole cut in the geotextile. Stockpile coarse aggregate on polyethylene sheeting.
- Place patch of geotextile over hole. Provide for a minimum six (6)-inch overlap. If borehole has a monitoring well installed, cut hole in geotextile patch slightly larger than the diameter of the casing and place patch around casing.
- Replace stockpiled coarse aggregate. Fill remainder of hole with appropriate IRM material.

#### **3.4.3 Boreholes in Aggregate-Covered IRM Site Areas**

- Grout borehole to original surface, but below IRM covering, using the methods outlined above. Allow 24 hours for cement grout to cure.
- Clean surface around borehole by removing the 10 foot by 10 foot, polyethylene sheeting protecting the IRM surface adjacent to the borehole. Remove steel plate and temporary casing which was used to also protect the IRM covering while drilling.

- Cut top layer of geotextile and geomembrane to allow for patching of lower geotextile layer. Patch lower layer of geotextile, providing appropriate overlap.
- Patch geomembrane layer using manufacturer-recommended geomembrane patch and patching technique. If borehole has a monitoring well installed, place geomembrane collar patch around riser pipe and patch with the appropriate manufacturer-recommended patching technique.
- Patch top layer of geotextile, providing a minimum six (6)-inch overlap.
- Replace stockpiled coarse aggregate to appropriate elevation.

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## **4.0 SEDIMENT SAMPLING PROCEDURES**

Sediment composite and grab samples will be collected from depths of 0 to 36 inches from the Hackensack River mudflats on the outboard side of the planned Steel Sheet Pile barrier wall. Sediment samples will be obtained to support waste classification. Locations are depicted on Figure 1-2. Sample locations may be offset slightly from those depicted on Figure 1-2 contingent upon the presence of large pieces of solid debris (e.g., brick or concrete rubble). The approximate locations of the sediment samples will be recorded using a hand-held Global Positioning System instrument at the time of sample collection.

Previous sediment reconnaissance has demonstrated that the mudflats are accessible at low tide. Hence, sediment sample location need not be accessed using a boat. Local tide tables will be reviewed by field personnel to develop appropriate logistics for the sediment sampling effort. It is planned that two sampling crews will be used to obtain the sediments given the desire to obtain the samples during one mobilization.

Samples will be obtained in accordance with the procedures outlined in KEY SOP No. 101 provided in Attachment A. The volatile organic fraction samples will be grab samples obtained directly from the sediment bed using Encore samplers. The remaining sample fractions will be obtained from a homogenized composite of the top 3 feet of the sediment bed. Samples will be obtained from this depth interval with a hand auger and will be composited in a stainless steel mixing bowl prior to sample acquisition. Actual samples will be obtained from the homogenized material with disposable plastic scoops.

The sediment sampling and analysis program is designed to provide information for classification of the sediments targeted for removal from the river (including pore water). Any excess water present in the sediment samples will be decanted in the field (the laboratory will analyze the samples on an as-received basis – any separation of water and solids that may have occurred during sample shipping and storage will be eliminated via shaking of the samples once the laboratory commences preparation). Analytical results for the sediment samples will be reported on a dry weight basis. The planned analytical program for the sediment samples is discussed in the IRAW and the attendant QAPP (Appendix E of the IRAW).

Sample bottles will be provided by the laboratory and will accommodate the multiple different analyses that must be conducted. Given the types of analyses to be completed, it is considered unlikely that all the analysis will be completed at the same laboratory location. The laboratory will be instructed to provide the minimum number of bottles necessary to accommodate the various fractions, considering the specific locations where the analyses will be conducted. Sample handling, labeling, chain-of-custody, and documentation procedures are discussed in Section 9.0.

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## **5.0 MONITORING WELL AND PIEZOMETER INSTALLATION**

As indicated in the IRAW and as shown on Figure 1-2, new monitoring wells and piezometers will be installed to facilitate evaluation of the effectiveness of the interim response. Procedures for monitoring well and piezometer installation will generally follow the applicable KEY SOPs provided in Attachment A as follows:

- Monitoring well/piezometer drilling methods are discussed in KEY SOP No. 110;
- Monitoring well/piezometer construction procedures are discussed in KEY SOP No. 123;
- Monitoring well/piezometer grouting techniques are discussed in KEY SOP No. 111; and,
- Monitoring well/piezometer development procedures are discussed in KEY SOP No. 112.

The planned monitoring wells/piezometers will be screened in either the upper fill zone or the deeper sand zone contingent upon the planned hydraulic monitoring location. The following specifications apply:

- For the proposed monitoring wells and piezometers, PVC well screen and riser are acceptable materials for use because contact with DNAPL is not expected. In the event that DNAPL is present, the wells will be constructed of stainless steel or other materials that are compatible with the constituents that are present in the specific area.
- Some monitoring well/piezometer borings will be advanced through COPR fill and, therefore, installation of surface casing through the fill into the meadow mat will be required. Organic constituent concentrations in the shallow fill zone are typically lower than those in the deeper sand unit. Therefore, in the absence of COPR soil fill materials, installation of a casing into the meadow mat may not be necessary. However, in the event that DNAPL is observed in the shallow fill, surface casing will be installed and keyed into the meadow mat to prevent downward DNAPL migration during borehole drilling.
- The sand unit to be monitored is generally less than 10 feet thick. As a result, a five-foot screen section will be installed. This will permit the installation of a bentonite seal below the base of the meadow mat to prevent hydraulic communication between the fill and sand units. If the sand unit is found to be less than seven-feet thick, a shorter screen length will have to be installed to allow for placement of the bentonite seal below the meadow-sand unit interface.

The NJDEP regulations do not permit the installation of a bentonite pellet seal to seal the well bore above the screened section. As a result, a minimum one (1)-foot thickness of fine grained

sand will be installed above the gravel pack to prevent intrusion of the bentonite/cement/grout into the well screen interval.



## **6.0 GROUNDWATER AND DNAPL SAMPLING PROCEDURES**

Groundwater and DNAPL sample acquisition are discussed in this section. Groundwater sampling is discussed in Section 6.1. DNAPL sampling is discussed in Section 6.2.

### **6.1 GROUNDWATER SAMPLING PROCEDURES**

Groundwater sampling activities to support treatment plant design will be accomplished by low-flow purging and sampling techniques in accordance with the NJDEP Low Flow Purging and Sampling Guidance as outlined in Section 9.2.2.2 of the NJDEP Field Sampling Procedures Manual (August, 2005). Each well will be temporarily equipped with adjustable rate, positive displacement bladder pumps, or submersible pumps, with Teflon<sup>®</sup> bladders, and Teflon<sup>®</sup>-lined polyethylene tubing.

Prior to initiating purging activities, measurements of depth to water, depth to and thickness of DNAPL, and total well depth will be made in accordance with KEY SOP No. 109. Measurements will be taken from the surveyed reference mark on the top of the inner well casing in accordance with the NJDEP FSPM, 6.9.2.2.5.9. All measurements will be recorded in the field notebook and monitoring data sheets.

Monitoring well purging will be initiated at a rate of 100-500 milliliters per minute (ml/min) as described in Section 6.9.2.2.5.11 in the NJDEP FSPM. The flow rate will be determined by recording the volume pumped into a graduated container (*e.g.* 1,000 milliliter beaker) over a specific time period. The water level will be monitored and the pumping rate will be adjusted during the initial stages of purging as necessary to prevent excessive drawdown of the water level within the monitoring well.

Field measurements of pH, temperature, specific conductance, turbidity, temperature, and oxidation-reduction potential (ORP) will be performed during purging at 3-5 minute intervals in accordance with Section 6.9.2.2.5.2 in the NJDEP FSPM. These parameters will be measured by means of a flow-through cell equipped with the appropriate monitoring probes. Measurements will be recorded on monitoring forms and in the field notebook in accordance with the NJDEP FSPM, 6.9.2.2.2. Purging will be determined to be complete when the field indicator parameters have stabilized in accordance with the criteria specified in the NJDEP guidance or after four hours of purging, whichever occurs first.

Groundwater samples will be obtained immediately after purging criteria have been met. The samples will be collected by directly filling the sample bottles from the pump discharge line (with the flow-through cell removed or bypassed) in accordance with the NJDEP FSPM, 6.9.2.2.5.12. The flow rate of the discharge will be adjusted, as necessary, to minimize turbidity and aeration.

## **6.2 DNAPL SAMPLING PROCEDURES**

DNAPL sample collection will be conducted in accordance with KEY SOP No. 154. Prior to sample collection, measurements of depth to water, depth to and thickness of DNAPL, and total well depth, will be made in accordance with KEY SOP No. 116. The samples will then be collected with a peristaltic pump or a bottom-filling bailer. If a bailer is used, the DNAPL will be transferred to the sample container using a bottom-emptying device. Care will be taken to minimize the amount of water collected.

## **7.0 LAGOON STORM WATER SAMPLING PROCEDURES**

Four lagoon storm water samples will be obtained to support determination of water treatment requirements associated with lagoon dewatering. Two samples will be obtained from the East Lagoon and two will be obtained from the West Lagoon. Planned sample locations are depicted on Figure 1-2 but may be modified based on actual field conditions (i.e., the water levels in the lagoons may be such that alternative locations in deeper portions of the lagoons must be used).

Surface water samples will be collected using a plastic dip sampler and the requisite sample bottle will be filled directly from the dip sampler. Sampling will be completed in accordance with KEY SOP No. 124 provided in Attachment A. Care will be exercised during submergence of the dip sampler to avoid unnecessary agitation of both the surface water and proximate solids. The dip sampler will also be carefully lifted from the ponded water to avoid agitation. Storm water from the dip sampler will be decanted slowly into the sample bottles to avoid agitation, particularly for the volatile organic compound samples. Sample handling, including chain-of-custody, etc. is described in detail in Section 9.0.

## **8.0 EQUIPMENT DECONTAMINATION**

All equipment involved in sample collection must be either new and disposable or decontaminated prior to initiation of on-site activities, between each use and prior to demobilization from the site. Sampling equipment decontamination will be conducted according to the applicable procedures provided in KEY SOP No. 115 (Attachment A) and the NJDEP FSPM.

Heavy equipment such as drill rigs and backhoes, including all downhole equipment such as auger flights, drill rods, and drill bits shall be decontaminated before arrival at the Site and between each drilling/excavation location by pressure steam cleaning with potable water and, if needed, manual scrubbing at a designated decontamination pad.

Soil sampling is primarily being conducted for field classification of soils and for geotechnical testing. Soil sample collection equipment, such as split-spoon samplers, will be decontaminated between each use by detergent solution wash and potable water rinse. For sampling equipment used to collect samples for laboratory analysis for VOCs and SVOCs, an isopropyl alcohol rinse and de-ionized water rinse will be completed following the detergent wash and potable water rinse.

Well pumps will additionally be flushed with detergent solution and potable water to clean the internal components.

## **9.0 MANAGEMENT OF INVESTIGATION-DERIVED WASTES**

Investigation-derived waste (IDW) generated during sampling activities will likely include the following:

- Drill cuttings,
- Purge water,
- Decontamination fluids,
- Personal protective equipment (PPE), and
- Disposable sampling equipment.

Management of IDW will be conducted according to the applicable procedures provided in KEY SOP No. 122 (Attachment A).

Soils that show no evidence of impact will be spread onto the ground surface in the area immediately surrounding the borehole. Water that is not impacted will be re-infiltrated into the ground surface at its point of generation.

Potentially-impacted IDW will be containerized, staged, and characterized before being managed of in an appropriate manner conforming to NJDEP FSPM Section 6.5. The following presents preferred approaches to management of the potentially impacted IDW which are consistent with the NJDEP Field Sampling Procedures Manual.

- Potentially-impacted soils (i.e., drill cuttings) will be containerized and stored in common areas on the SCCC and Diamond Sites. Ultimately, the soils will be addressed through implementation of the interim response action by consolidation beneath a surface cover located on the site of the IDW origin and/or offsite treatment/disposal.
- Potentially-impacted groundwater will be collected in containers for subsequent offsite treatment/disposal or treatment in the onsite groundwater treatment plant.
- Non-impacted PPE or disposable sampling equipment will be managed as general refuse. Such materials that have been affected by site constituents will be containerized for subsequent off-site disposal at a permitted facility.

## **10.0 SAMPLE HANDLING**

The following sections detail the procedures for the handling, documentation, and analysis of soil, sediment, groundwater, storm water, and DNAPL samples for chemical analysis. The sampling procedures will be conducted in accordance with the NJDEP FSPM, Chapter 6.

### **10.1 SAMPLE ANALYSIS**

Chemical analyses of soil, sediment, groundwater, storm water, and DNAPL samples will be completed according to the requirements presented in the QAPP and this FSP. A summary of the analytical parameters and methods is provided in Section 2.0. All chemical analyses will be performed by a New Jersey Certified Laboratory. Laboratory certification shall be in accordance with N.J.A.C. 7:18, and the NJDEP FSPM 6.9.2.2.4.

### **10.2 SAMPLE CONTAINERS**

Sample containers and appropriate preservatives (where necessary) will be supplied by the analytical laboratory. After the respective sample containers have been filled with appropriate sample media and preserved as necessary, samples will be properly identified using sample container labels. Sample container specifications are described in the QAPP (Appendix E of the IRAW) and KEY SOPs No. 103 and 114 (Attachment A).

### **10.3 SAMPLE DESIGNATIONS**

The sample designation system that exists for the SCCC and Diamond Sites will be carried through the design data acquisition activities. Sample location designations are depicted on Figure 1-2 and are listed in Table 2-1.

### **10.4 LABELING, PRESERVATION, AND CHAIN OF CUSTODY**

Post sampling activities will be performed in accordance with the NJDEP FSPM, 6.1.7. Each sample bottle will be labeled prior to filling. The sample labels will include, but not be limited to, the following information:

- Project/Site Name;
- Sample Identification (Location and Depth);
- Sample Collection Time and Date;
- Sampler's Initials;
- Preservative, if applicable, mark "None" if unpreserved; and,
- Requested Analyses.

Labels will be completed with indelible ink, and protected with a wrapping of transparent tape (if necessary to prevent label damage).

Samples for chemical analysis shall be preserved as necessary. Preservation requirements are described in KEY SOPs No. 103 and 114 (Attachment A). Filled sample bottles will be placed in a cooler and chilled to a temperature of four (4) degrees Celsius (°C) and maintained at this temperature pending delivery to the laboratory. Ice or re-freezable ice packs will be used to maintain proper sample temperature. If ice is used, ice will be packaged in sealable plastic bags to minimize contact of water with the sample containers. A temperature blank is to be provided by the laboratory for each sample shipment container, and will accompany the sample shipping container and samples back to the laboratory. The laboratory will use the temperature blank vial to check the temperature of the samples when they are received at the laboratory.

A record of all samples collected will be maintained in the project field logbook, associated field monitoring and sampling forms, and chain-of-custody (COC). The original copy of the completed COC will accompany all samples shipped from the Site to the laboratory. The COC will either be placed in the sample shipping package (e.g., cooler), or hand-delivered to the laboratory courier or sample receiving department personnel. If the COC is shipped within the sample cooler, the COC will be placed in a sealable water-resistant bag (e.g., Ziploc<sup>®</sup> bag) and taped to the inside of the cooler's lid. A copy of the completed COC will be retained by the sampling personnel. A detailed description of COC requirements are described in KEY SOP No. 105 (Attachment A).

## **10.5 SAMPLE SHIPPING**

All samples will be transported to the analytical laboratory in durable, waterproof, and secured plastic coolers. Sample coolers will generally be supplied by the laboratory. All samples will be packaged very carefully to prevent sample breakage. Samples will be shipped via overnight carrier (e.g., Federal Express, Airborne, United Parcel Service), courier service provided by the laboratory or hand delivered to the analytical laboratory, generally within 36 hours of collection. However, shipments containing samples for analysis of hexavalent chromium will be delivered to the laboratory as soon as possible after collection due to holding time considerations. Additionally, the sample security and preservation must be maintained if samples are not to be transported immediately to the laboratory. A detailed description of the sample shipment procedures are provided as KEY SOP No. 114 (Attachment A).

## **10.6 SAMPLE DOCUMENTATION**

All data and information generated in the field will be recorded directly into bound notebooks. Field logbooks are the primary source of documentation for all site activities. They serve as legal record of all investigative activities. All pertinent information regarding the site and sampling procedures must be documented.

Information recorded in the notebook should be noted with the date and time of entry. The following items should be included as logbook entries in addition to the field data and measurements acquired during the investigation:

- Name and location of site;
- Date and time of arrival and departure;
- Sampling event description;
- Prevailing weather conditions;
- Names affiliations of persons on-site and purpose of visit;
- Subcontractor equipment on-site;
- Name of person keeping log;
- Equipment calibration record;
- IDW log
- Photographic log.

The sampling event description should include methodology, sample numbers and volumes, description of samples, date and time of sample collection, and name of sample collector. All information should be recorded in permanent ink for the legal record. The page of the logbook should be numbered for ease of reference. At the end of each field day, the project scientist/engineer or his designee should sign and date the notebook to verify the day's activities. A detailed description of the field logbook documentation procedure is provided as KEY SOP No. 106 (Attachment A).



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## **11.0 FIELD QUALITY ASSURANCE/QUALITY CONTROL SAMPLES**

Quality assurance/quality control (QA/QC) for field sampling efforts will be conducted in accordance with the NJDEP FSPM, 2.5 and primarily be measured via the collection of field QC samples, which consist of the following:

- Field duplicates;
- Equipment blanks;
- Trip blanks.

### **11.1 FIELD DUPLICATES**

Field duplicates are used to evaluate the sample collection and analyses effects on the reproducibility of data. Field duplicates are collected by splitting a sample evenly between the primary sample and QA/QC sample containers. For instance, a groundwater sample bailer would be emptied, in relatively equal volumes, into two sample containers (one for the primary sample of record and one for the QA/QC duplicate).

Field duplicates of soil samples for all analyses except volatile organics will be taken by homogenizing the soil in a stainless steel bowl and then placing replicate portions into the sample containers. Field duplicates for volatile analyses will be collected as separate samples from the same location or boring depth. Preservation and filtration will be performed as necessary for the appropriate analysis. One field duplicate for each analysis for each sampling event or one (1) per every 20 samples will be collected, whichever is greater.

### **11.2 EQUIPMENT BLANKS**

Equipment blank data are used to evaluate field decontamination procedures. Equipment blanks will be collected by pouring analyte-free water, supplied by the analytical laboratory, through a decontaminated sample bailer or over decontaminated soil sampling utensils into the sample bottles. Preservation and filtration will be performed as necessary for the appropriate analyses. For equipment that is decontaminated and re-used, one equipment blank will be collected per day for each type of equipment used.

If disposable equipment is used, the field blank will be taken from a rinse of the equipment prior to sampling use. One field blank per sampling event will be sufficient for each type of disposable instrument used.

### **11.3 TRIP BLANKS**

Trip blank data will be used to evaluate exposure to volatile organic constituents during sampling, shipping and storage at the laboratory. The prepared trip blanks are to be transported

with the VOC vials to the field. Trip blanks for a particular date of submission will, if practical, be transported back to the various sample locations and transported back to the laboratory in the sample shipment container with all other VOC samples for that data. One set of trip blanks will be included in each cooler containing VOC sample vials and will be analyzed for the same list of VOCs as the primary samples.

## **12.0 SURVEY OF SAMPLE LOCATIONS**

Soil boring and monitoring well locations will be surveyed under the direction of a New Jersey-licensed surveyor. Horizontal control for these well locations will be tied into the New Jersey State Plane Coordinate System referenced to the North American Datum of 1927 (NAD 1927). Vertical control will be tied to the North American Vertical Datum of 1929 (NGVD 1929).

The ground surface elevation for each soil boring and new monitoring well, and the measuring point elevation for each new monitoring well (a measurement reference point will be etched onto the well casing or marked in permanent ink to allow for accurate reproducible water-level measurements over time), will be surveyed to the nearest 0.01 foot above mean sea level. The plan location of each well and boring will be surveyed to an accuracy of approximately 0.1 foot. The surveyor will complete NJDEP Form B - Monitoring Well Location Certification, and submit the forms to NJDEP for each completed well.

## **TABLES**

TABLE 2-1  
SUMMARY OF DESIGN DATA ACQUISITION SAMPLING AND ANALYSIS<sup>(1)</sup>  
SCCC AND DIAMOND SITES  
KEARNY, NEW JERSEY

Location	Description	IRAW Text Section	Sample Matrix	Boring Depth (ft)	Sample Depth (ft)	Required Analyses <sup>(2)</sup>																							Sampling Method	Purpose	
						TCL VOCs	TCL SVOCs	TAL Metals	Hexavalent Chromium	TCL PCBs	PCDD & PCDF	Cyanide	TCLP	RCRA	BTU Content	TCL Pesticides	TSS	TDS	Alkalinity	BOD	COD	TOC	Oil & Grease	Field Parameters	TOX	Physical Suite A	Physical Suite B	Physical Suite C			Physical Suite D
SOIL/LAGOON SOLIDS/SEDIMENT WASTE CLASSIFICATION SAMPLING																															
BW-1 through BW-20	Slurry Wall Spoils Classification Samples	4.1	Soil	30-60	0-60																									Split Spoons	Characterization of Slurry Wall Spoils for Backfill/Consolidation/Disposal
WLWC-001 through WLWC-004	West Lagoon Solids	4.4	Solids	-	~0-6																									Excavator	West Lagoon Waste Classification Sampling and Analysis
ELWC-001 through ELWC-006	East Lagoon Solids	4.4	Solids	-	~0-6																									Excavator	East Lagoon Waste Classification Sampling and Analysis
HRWC-01 through HRWC-06	Near-Shore River Sediment	4.5	Sediment	-	0-3																									Hand Auger	Hackensack River Sediment Waste Classification Sampling and Analysis
SDWC-01 through SDWC-05	South Ditch Sediment	4.7	Sediment	-	0-2																									Hand Auger	South Ditch Soft Sediment Waste Classification Sampling and Analysis
GROUNDWATER TREATMENT PLANT DESIGN SAMPLES																															
Shallow Fill Zone Monitoring Wells <sup>(3)</sup>	Groundwater Treatment Plant Design Samples	4.2	Ground Water	-	Upper Zone (Fill)																									Low Flow	Groundwater Treatment System Design
Deeper Sand Zone Monitoring Wells <sup>(3)</sup>	Groundwater Treatment Plant Design Samples	4.2	Ground Water	-	Lower Zone (Sand)																									Low Flow	Groundwater Treatment System Design
LAGOON DEWATERING TREATMENT PLANT DESIGN SAMPLES																															
WLSW-01 & WLSW-02 ELSW-01 & ELSW-02	Lagoon Storm Water Samples	4.4	Storm Water	-	Grab																									Grab Samples	Temporary Treatment Plant Design
DNAPL CHARACTERIZATION SAMPLES																															
MW-3L & MW-13L	DNAPL Chemical and Physical Samples	4.3	DNAPL	NA	Bottom of Well																									Low Flow	Recovery System Design and Recycling/Disposal Assessment
GEOTECHNICAL/PHYSICAL PARAMETER SOIL SAMPLES																															
GT-5 through GT-7	Geotechnical Analysis for Structural Wall Design	4.1	Soil	60	0-60																									Split Spoons Shelby Tubes	Engineering Analysis of Barrier Wall
BW-1 through BW-7	Geotechnical Analysis for Structural Wall Design	4.1	Soil	60	0-60																									Split Spoons Shelby Tubes	Engineering Analysis of Barrier Wall
BW-8 through BW-20	Geotechnical Analysis for Structural Wall Design	4.1	Soil	30	0-30																									Split Spoons Shelby Tubes	Engineering Analysis of Barrier Wall
DS-1 through DS-6	DNAPL Recovery System Borings	4.3	Soil	30	0-30																									Split Spoons Shelby Tubes	Recovery Well Slot Size and Screen Length Determination
GT-1 through GT-4	Geotechnical Analysis for Stability/Settlement Analysis	4.4	Soil	30	0-30																									Split Spoons Shelby Tubes	Engineering Analysis of Interim Surface Cover - Lagoon Settlement

1. Sampling and analysis includes collection of chemical and physical characterization data as well as geotechnical data. Samples for geotechnical analysis will be a subset of multiple geotechnical samples collected during the drilling program.
2. The various analytical parameters and suites of analysis are as follows (where not self-evident):

TCL VOCs - Target Compound List Volatile Organic Compounds  
TCL SVOCs - Target Compound List Semi-Volatile Organic Compounds  
TAL Metals - Target Analyte List Metals

TCL PCBs - Target Compound List Polychlorinated Biphenyls  
PCDD/PCDF - Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans.  
TCLP - Toxicity Characteristic Leaching Procedure VOCs, SVOCs, and Metals

RCRA - Corrosivity, Ignitability, Reactivity  
TSS - Total Suspended Solids  
TDS - Total Dissolved Solids

BOD - Biological Oxygen Demand  
COD - Chemical Oxygen Demand  
TOC - Total Organic Carbon

BTU - British Thermal Unit  
TOX - Total Organic Halogens

Physical Suite A - Grain Size, Total Organic Carbon, Moisture Content.  
Physical Suite B - Specific Gravity, Viscosity, Interfacial Tension, Moisture Content.  
Physical Suite C - USCS Soil Classification, Moisture Content, Gradation, Hydrometer Analysis, Atterberg Limits, Specific Gravity, One-Dimensional Consolidation, Consolidated Undrained Triaxial Shear (3 points each), Permeability, Bulk Density.  
Physical Suite D - UCSC Soil Classification, Gradation, Hydrometer Analysis.  
Physical Suite E - USCS Soil Classification, Moisture Content, Gradation, Hydrometer Analysis, Atterberg Limits, Consolidated Undrained Triaxial Shear (3 points each).

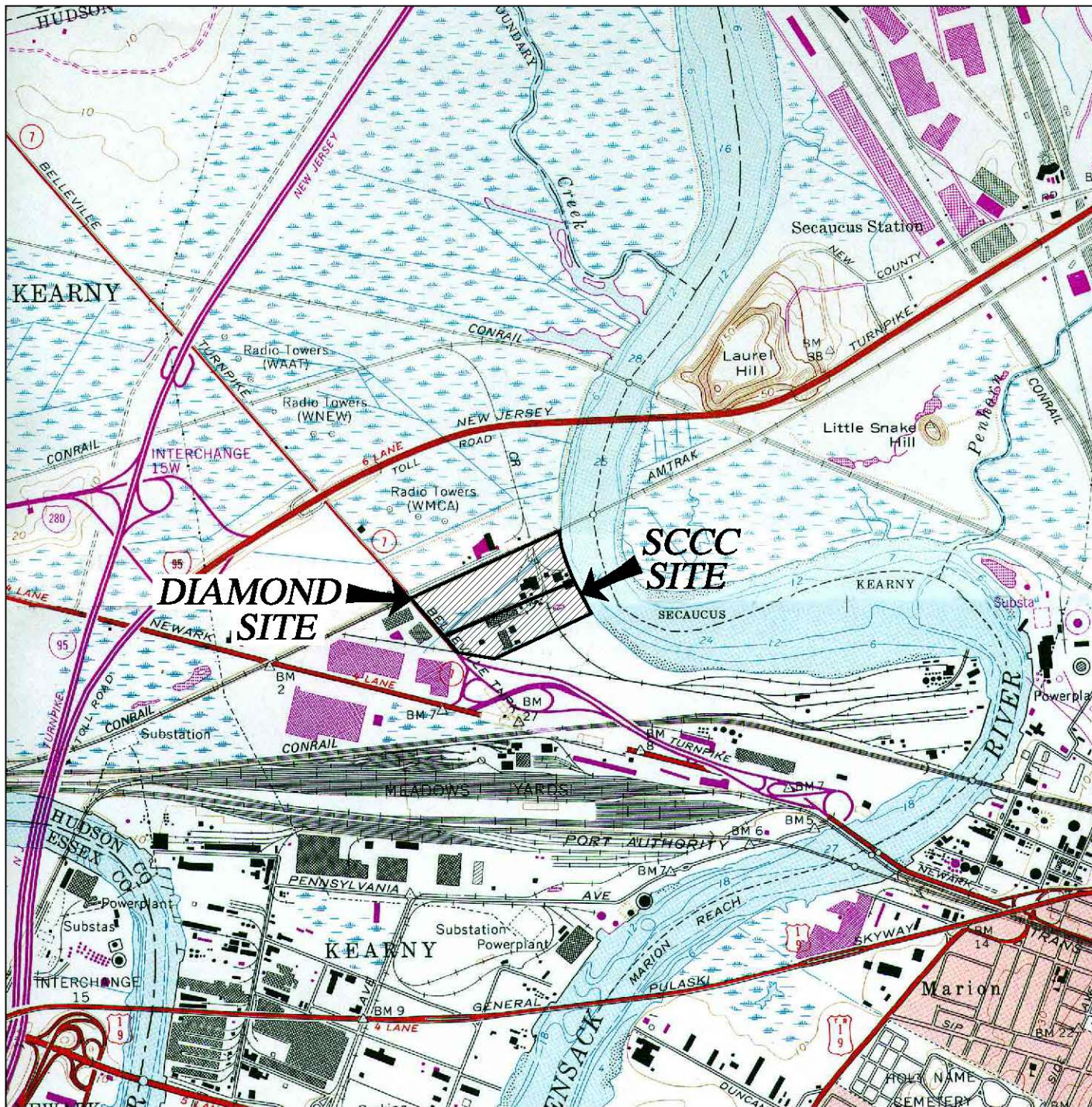
Field parameter analysis for groundwater samples consists of pH, Oxidation-Reduction Potential (ORP), Specific Conductance, Temperature, Turbidity, Water Levels, DNAPL Thickness.  
Field parameter analysis for storm water samples consists of pH, ORP, Specific Conductance, Temperature, and Turbidity.

3. Barrier wall alignment borings BW-1 through BW-8 to be installed to a depth of 60 feet. Barrier wall alignment borings BW-9 through BW-20 to be installed to a depth of 30 feet.
4. Groundwater samples will be obtained to support design of the groundwater treatment system. Samples will be obtained from shallow fill zone and deeper sand zone wells. Wells to be sampled are as follows:

Shallow Fill Zone Wells	113-W-113	113-W-115	113-W-120	SC-PZ-1U	SC-PZ-3U	SC-PZ-5U	SC-PZ-12U	SC-PZ-15U
	113-W-114	113-W-116	113-W-121	SC-PZ-2U	SC-PZ-4U	SC-PZ-11U	SC-PZ-14U	MW-109
Deeper Sand Zone Wells	SC-MW-2L	SC-MW-3L	SC-MW-4L	SC-MW-8L	SC-MW-12L	SC-MW-13L	SC-MW-14L	SC-MW-15L

## **FIGURES**





REFERENCE:

REFERENCE: USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLES  
OF JERSEY CITY, AND WEEHAWKEN, NEW JERSEY

ISSUE DATE:

KEY ENVIRONMENTAL, INC.  
200 THIRD AVENUE  
CARNEGIE, PA 15106

## PENINSULA RESTORATION GROUP

DRWN: GLC  
CHKD: RJH  
APPD: JSZ  
SCALE: 1" = 2000'

DATE: 5-08-07

DATE: 5-09-07

DATE: 5-09-07

**KEY** ENVIRONMENTAL  
INCORPORATED

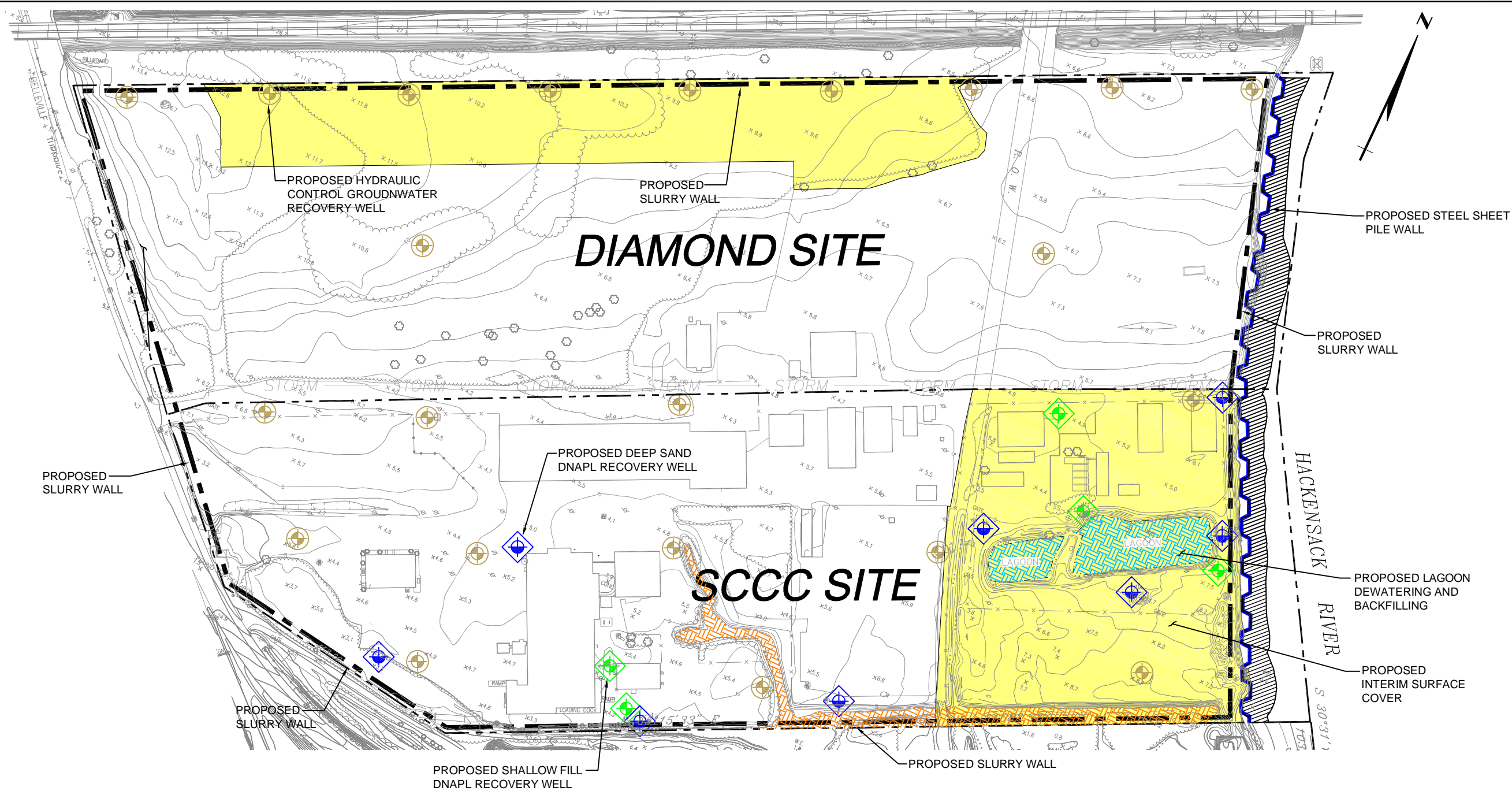
INTERIM RESPONSE ACTION FIELD SAMPLING PLAN  
SCCC AND DIAMOND SITES  
KEARNY, NEW JERSEY

SITE LOCATION MAP

PROJECT NO: 07-417  
FIGURE 1-1

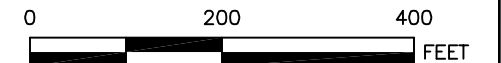


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## LEGEND

	EXISTING ACCESS ROAD		EXISTING CONCRETE PAD		PROPOSED LAGOON DEWATERING AND BACKFILLING
	EXISTING NEW JERSEY TRANSIT RAILROAD (ACTIVE)		EXISTING GROUND SURFACE ELEVATION CONTOURS		PROPOSED SEDIMENT REMOVAL
	EXISTING FENCE		EXISTING VEGETATION		PROPOSED DRAINAGE DITCH REMEDIATION (EXCAVATION AND BACKFILL)
	EXISTING STRUCTURES		EXISTING STREAM, POND AND RIVER BANK		PROPOSED INTERIM SURFACE COVER
	EXISTING UTILITY POLES		EXISTING ELEVATION (FEET-MSL)		
	EXISTING LIGHT STANDARD		PROPOSED SLURRY WALL LOCATION		
	EXISTING OVERHEAD POWER LINE		PROPOSED STEEL SHEET PILE WALL LOCATION		
	PROPERTY BOUNDARY				



PENINSULA RESTORATION GROUP

DRWN: GLC	DATE: 5-07-07
CHKD: RJH	DATE: 5-07-07
APPD: JSZ	DATE: 5-07-07
SCALE:	AS SHOWN



INTERIM RESPONSE ACTION FIELD SAMPLING PLAN  
SCCC AND DIAMOND SITES  
KEARNY, NEW JERSEY

INTERIM RESPONSE ACTION PLAN

PROJECT NO: 07-417  
FIGURE 1-2

ISSUE DATE:

KEY ENVIRONMENTAL, INC.  
200 THIRD AVENUE  
CARNEGIE, PA 15106

REFERENCE: 1. VERTICAL REFERENCE: NATIONAL GEODETIC VERTICAL DATUM (NGVD 1929).

REV #	DATE	DESCRIPTION	APPD



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NOTE:

1. GEOTECHNICAL BORINGS GT-3 AND GT-4 WILL BE USED TO OBTAIN DATA FOR THE DNAPL RECOVERY SYSTEM DESIGN COMPARABLE TO DATA OBTAINED FROM DS-1 THROUGH DS-6.
2. SEPTIC TANK CONTENTS WILL ALSO BE SAMPLED AS DESCRIBED IN SECTION 4.7 OF THE IRAW.

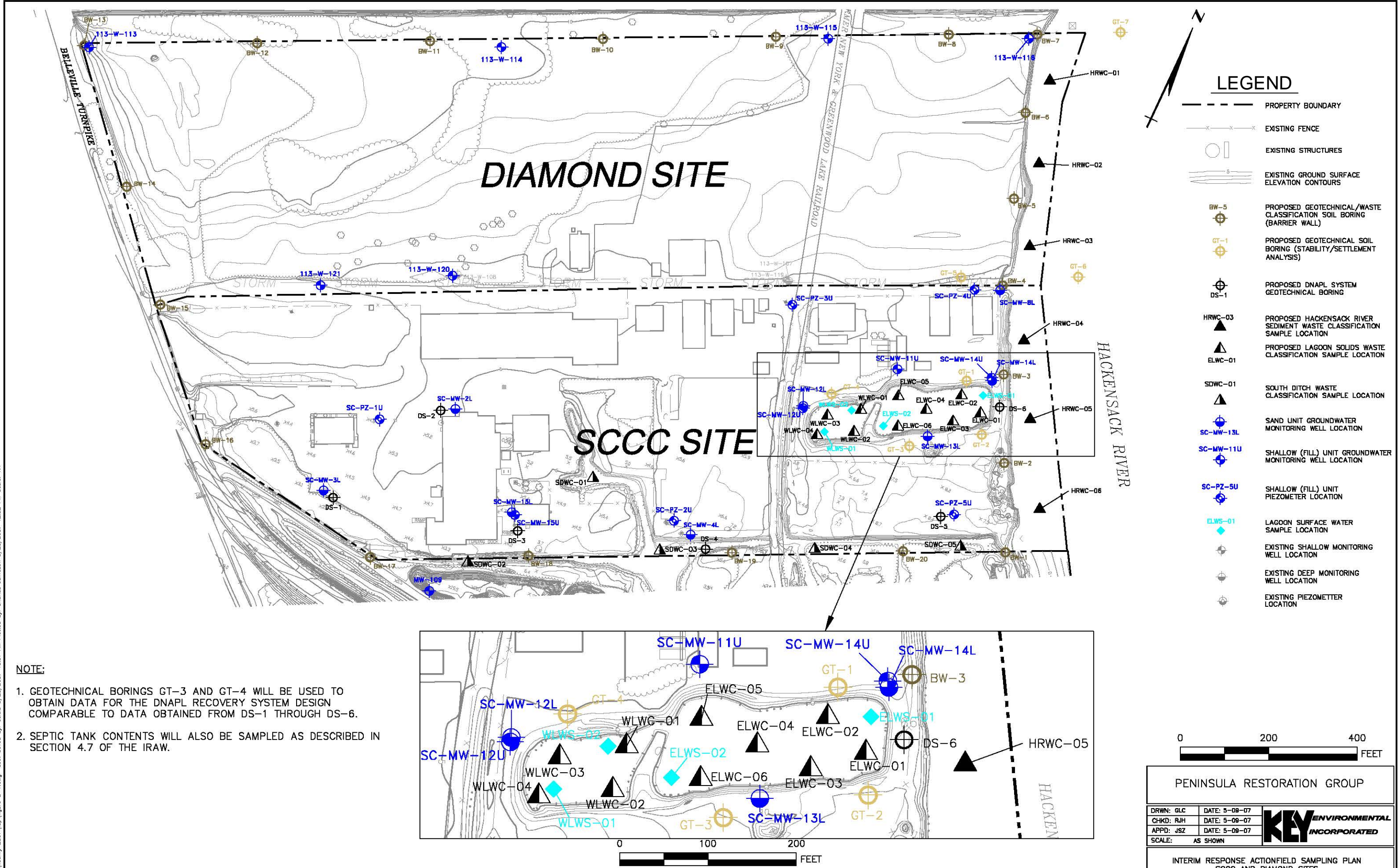
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REV #	DATE	DESCRIPTION	APPD

REFERENCE:

ISSUE DATE:

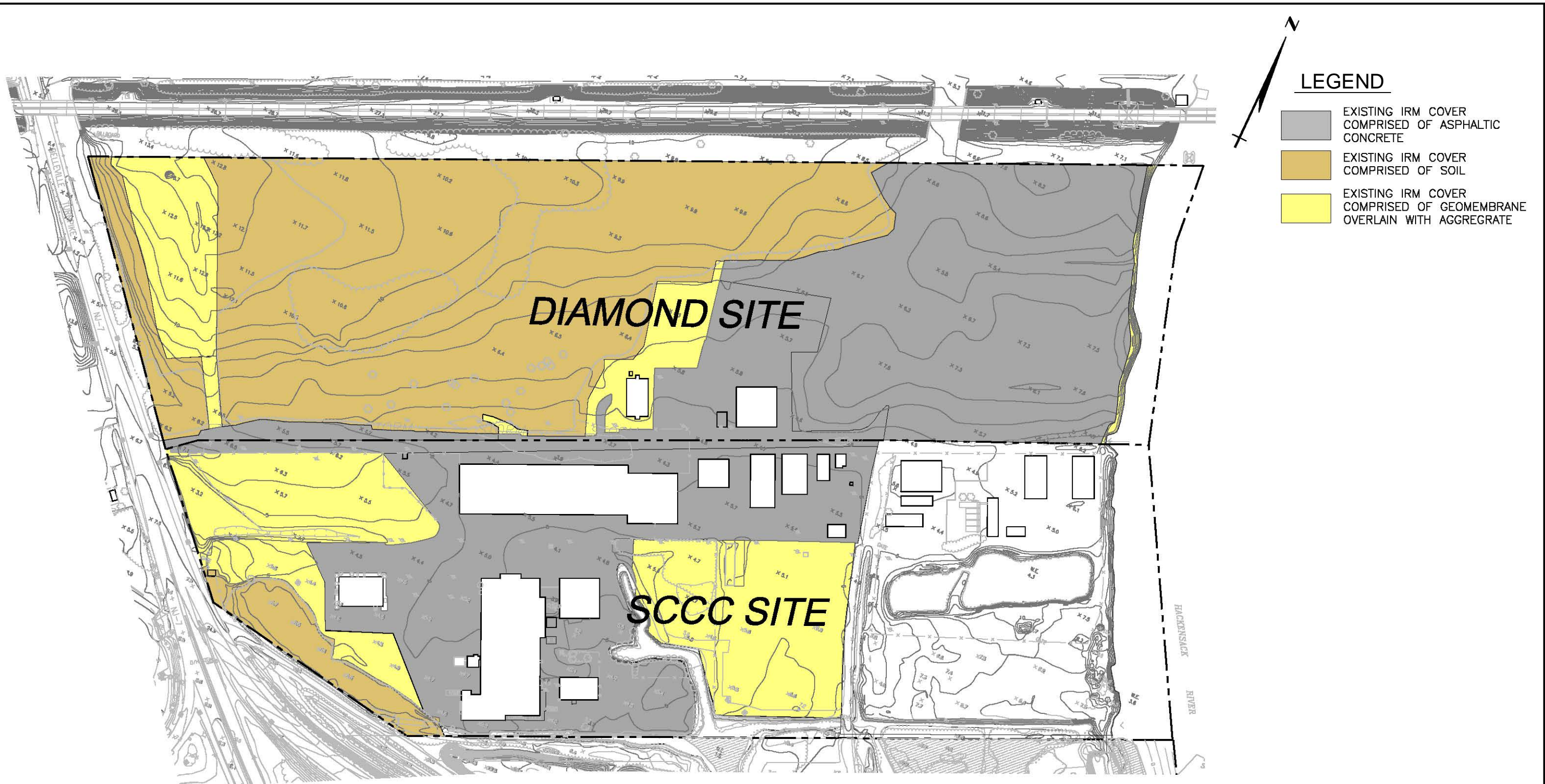
KEY ENVIRONMENTAL, INC.  
200 THIRD AVENUE  
CARNEGIE, PA 15106

PENINSULA RESTORATION GROUP	
DRWN: GLC	DATE: 5-08-07
CHKD: RJH	DATE: 5-08-07
APPD: JSZ	DATE: 5-08-07
SCALE: AS SHOWN	
INTERIM RESPONSE ACTIONFIELD SAMPLING PLAN SCCC AND DIAMOND SITES KEARNY, NEW JERSEY	
PROPOSED TEST BORING/SAMPLE LOCATION MAP	PROJECT NO: 07-417 FIGURE 2-1





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**LEGEND**

- EXISTING IRM COVER  
COMPRISED OF ASPHALTIC  
CONCRETE
- EXISTING IRM COVER  
COMPRISED OF SOIL
- EXISTING IRM COVER  
COMPRISED OF GEOMEMBRANE  
OVERLAIN WITH AGGREGATE

**NOTES:**

1. DIAMOND SITE CONSOLIDATION AREA AND COVER SYSTEM TO BE USED ONLY IF SLURRY WALL SPOILS ARE PLACED IN THIS AREA CONTINGENT UPON AOC POLICY DETERMINATION OR WASTE CLASSIFICATION.

REV #	DATE	DESCRIPTION	APPD

REFERENCE:	

ISSUE DATE:	
KEY ENVIRONMENTAL, INC. 200 THIRD AVENUE CARNEGIE, PA 15106	

PENINSULA RESTORATION GROUP

DRWN: GLC	DATE: 5-3-07
CHKD: AFB	DATE: 5-3-07
APPD: JSZ	DATE: 5-3-07
SCALE: AS SHOWN	

**KEY ENVIRONMENTAL INCORPORATED**

INTERIM RESPONSE ACTION FIELD SAMPLING PLAN  
SCCC AND DIAMOND SITES  
KEARNY, NEW JERSEY

SCCC AND DIAMOND SITE PLAN AND IRM LOCATIONS	PROJECT NO: 07-417 FIGURE 3-1
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**ATTACHMENT A**  
**STANDARD OPERATING PROCEDURES (SOPs)**

## #101 - SEDIMENT SAMPLING

### SCOPE

Sediment sampling defines the process of collecting saturated unconsolidated sedimentary material from the base of a water body (e.g., stream or lake). Sediment samples are usually collected in that section of the water body that displays sediment accumulation such as the inside of a meander or sand bar. Bottom sediments act as a sink for various types of contaminants and hence can provide a historical or cumulative record of contamination. For this reason, sediment samples are of importance in waste site evaluations where potential subsurface water contamination (past and present) and/or contaminated groundwater discharge are of concern.

### DEFINITIONS

**Disturbed Sample:** A sample in which various layers or areas within the matrix are mixed upon collection.

**Undisturbed Sample:** A sample collected in such a manner that natural layering created by depositional pattern is maintained during sample collection.

### METHODOLOGY

Most sediment sampling is completed with the use of simple tools. The deeper the water column above the sediment, the more difficult it is to obtain a sediment sample. The following sampling devices are commonly used to collect sediment samples:

- X Scoop samples;
- X Core samplers;
- X Hand operated gravity samplers; and,
- X Dredge samplers.

Sediment samples are usually collected with the same precautions taken for surface water samples. Samples should be taken in the area of least expected contamination first, and samples should be taken from the "downstream" side (if applicable) of the sample location to prevent sample disturbance and cross contamination.

The scoop sampler is a hand held or pole-extended device consisting of a stainless steel scoop (like a bakery scoop). The scoop is lowered through the water column and gently pushed into the sediment at the base of the water body. Care should be taken when crossing the water-sediment interface to reduce avoidable sample disturbance. The water laden sediment is then manually transferred into an amber glass or other appropriate sample jar.

Depth specific, undisturbed sampling of sediment is completed with the use of a core sample. Core samples, in addition to providing vertical analytical samples, allow the sedimentary record to be observed (such as bedding, bioturbation, etc.). A core sampler is usually constructed of a

metal outer barrel and a clear glass or teflon inner-barrel. The inner tube diameter is approximately 2 inches. The sampler is normally pushed into the sediment and the sediment forced into the inner barrel.

The inner barrel is then removed from the outer tube and usually sent intact to the analytical laboratory. This methodology has several limitations including relative density of sediment and grain size. If the sediment is too water laden, it will not remain inside the inner tube; similarly, if the grain size is too coarse, no sample will be retained by the inner tube.

Hand operated gravity corers are similar to core samplers but possess a coarse grained sediment trap in the inner tube, and the leading edge of the sample is designed for rotation of the cylinder. This design allows the sampler to take a disturbed sample of sediment not likely to be retained by the core sampler. When removed, water should be decanted from the top of the inner barrel before removing it. Clean sand should be placed at the top and bottom of the tube if there is any empty space at either end and plastic caps should be placed over each end.

Sediment dredges are utilized when the sediment is not readily obtainable (*i.e.*, at great depths or partially consolidated). The dredge consists of two claw-shaped metal buckets operated by a control hinge and line. Most dredges are very heavy and need to be operated with a winch and crane. This is the least likely methodology to be used because of cost and logistical concerns.

## **REFERENCES**

1. U.S. EPA REM III Program Guidelines FT-7.08.

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## #103 - ENVIRONMENTAL SAMPLE PREPARATION

### 1.0 SCOPE AND PURPOSE

This Standard Operating Procedure (SOP) presents procedures for selecting appropriate sample containers and preservatives when collecting environmental samples for analysis at a selected laboratory. Procedures for packaging and shipping environmental samples are presented in Key SOP #114.

Environmental samples are those that are anticipated to be relatively low in analyte concentration. These samples consist of materials that may have been impacted by source area materials, but do not consist of source area materials such as sludge, material from drums, material from bulk storage tanks, *etc.* Examples of environmental samples include: soil samples collected adjacent to or underlying a source area, stream and sediment samples, and groundwater samples (which do not contain non-aqueous phase liquid).

### 2.0 REQUIRED MATERIALS

Required materials for sample containers and preservation may include:

- various sized glass containers (with Teflon<sup>®</sup>-lined lids or caps, clear or amber colored);
- various sized polyethylene containers (with Teflon<sup>®</sup>-lined lids or caps);
- nitric acid;
- sulfuric acid;
- hydrochloric acid;
- sodium hydroxide; and,
- sodium thiosulfate.

Project-specific, appropriate sample container size, sample volume, holding times, and preservatives should be presented in the Quality Assurance Project Plan (QAPjP).

### 3.0 METHODOLOGIES

#### Sample Containers

To limit potential chemical or physical changes in a sample during collection and transport, the sample container selection should be based on the following:

- Sample containers should be new and certified clean prior to sampling activities;
- Sample containers should be constructed of non-reactive materials; and,
- Sample containers should not chemically or physically alter the sample.



The most widely used containers for aqueous samples are composed of glass or polyethylene.

## **Aqueous Samples**

### Glass Containers

Glass containers will be used when organic compounds are the analytes of interest. Sample volume will be sufficient to fill each sample container to allow the laboratory to attain the method-specific detection limits. Specific to volatile organic analysis, sample volume will be sufficient to fill each sample container so that no air bubbles are present. Once the sample container is full (and preserved if appropriate), it will be sealed with a Teflon<sup>®</sup>-lined screw cap. Specific container sizes for each analytical category are presented in the project-specific QAPjP.

### Polyethylene Containers

Polyethylene containers will be used for aqueous samples when metals and/or inorganic analytes are the parameters of interest. One-liter polyethylene bottles with solid polyethylene or polyethylene-lined caps will generally be used to collect groundwater samples for metals and inorganic analysis. Once the sample container is full (and preserved if appropriate), it will be sealed with the polyethylene screw cap. Specific container sizes for each analytical category are presented in the project-specific QAPjP.

## **Solid Samples**

Sample containers for the soil matrix are typically clear glass with a volume of 8 ounces. Larger sample containers may be necessary depending upon the number and type of analyses.

## **Sample Preservation**

Sample preservation is important to retard physical and chemical alterations of unstable analytes within the sample matrix. Sample preservation methods are limited and are generally intended to:

Retard biological action;

- Retard hydrolysis of chemical compounds and complexes;
- Limit photolysis;
- Reduce volatility of constituents; and,
- Reduce sorption effects.

Preservation is usually limited to acidification, treatment with an alkaline chemical, reducing light exposure, filtration, and refrigeration.

Prior to any form of preservation, the following parameters, at a minimum, will be measured in the field on water samples and recorded in the field notebook:

- pH;
- Specific conductance; and,
- Temperature.

These field measurements record baseline information on the water sample prior to external influences such as temperature, dissolved carbon dioxide, or oxygen affecting the sample.

### Acidification

Acidification of samples is generally performed for two purposes. Acidifying a (water) sample serves to limit metal adsorption to the sample container and will maintain the metal in a dissolved state. Secondly, acidification will act to inhibit bacterial growth. Samples to be acidified for either purpose will require a minimum volume of 100 ml and will be acidified to a  $\text{pH} < 2$ . Acidification is performed immediately after taking field measurements or following sample filtration.

### Alkaline Treatment

Samples are preserved with an alkaline chemical (e.g. NaOH) to form salts with volatile compounds such as cyanide. Samples undergoing this preservation require a minimum volume of 100 ml and will be treated to a  $\text{pH} > 12$ .

Preservation of the sample will be performed by the addition of NaOH until the desired pH is achieved ( $\text{pH} > 12$ ). Preservation of a water sample is performed immediately after the field measurements are collected and recorded.

### Filtration

Filtration of samples will be used only for specific analytical parameters. It will be used when the dissolved metal content of water is of concern. Filtration will not be performed for samples to be analyzed for volatile organics, semi-volatile organics, or total recoverable metals.

When sample filtration is required, the sample will be drawn through a 0.45 micron filter. The filter material will either be paper or fiberglass dependent on the nature of the sampled water. Filtration is performed immediately following the field measurements and prior to any other preservation methods. If the sample contains a significant level of suspended solids, a paper prefilter will be used prior to the 0.45 micron filter.



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### Temperature Control

All field samples that are to be analyzed by the laboratory will be sealed and then refrigerated during transfer to and storage at the laboratory. Refrigeration of samples is a bacterial inhibitor and slows the chemical and biological changes of a sample exposed to an oxidizing atmosphere. Transfer and storage of samples will be between 0°C and 10°C, with a target temperature of 4°C. Solid samples are typically limited to this preservation method.

### **Laboratory Selection and Coordination**

Choosing a qualified analytical laboratory is an integral part of sampling activities. Regulatory program requirements and certifications must be considered in selecting the laboratory to ensure that the laboratory is capable of meeting project-specific requirements. Also, the provisions of any Consent Orders or Unilateral Orders applicable to the project must be reviewed and communicated to the laboratory to ensure project-specific requirements are met.

### Laboratory Selection

- An analytical laboratory will be chosen based on the following criteria:
- Capabilities of the laboratory including performance history, certifications, and regulatory program experience;
- The qualifications and experience of the laboratory staff;
- Availability of a designated technical client representative who serves as a single point of contact for all Key projects;
- Quality and completeness of standard deliverables, including electronic data transfer availability;
- The specified analyses and turnaround time; and,
- The adequacy of the laboratory's quality assurance/quality control program.

### Coordination

After selecting a laboratory, the laboratory will be contacted and the following information requested pertaining to the sampling activities:

- Identification of a responsible party to act as sample custodian at the laboratory who is authorized to accept samples and verify the data entered from the accompanying chain-of-custody forms into the laboratory tracking system.

- Provisions for a laboratory sample custody log consisting of serially numbered, standard laboratory tracking report sheets.
- Specifications of laboratory sample custody procedures for sample handling, storage, and dispersment for analysis.

The laboratory will be notified within 48 hours prior to receipt of samples. The samples will be packaged and shipped *via* express courier or hand delivered within 48 hours of collection to the laboratory. The laboratory will then be contacted to verify receipt of the samples and estimated turnaround time.

### Sample Packaging and Shipping

Proper sample packaging and shipping accomplishes the following:

- Allows individual samples to be tracked through transport and analysis;
- Limits the possibility of breaking or losing a sample bottle during transport; and,
- Is part of formal chain-of-custody (COC) procedures (tracking of possession of the samples).

Samples will be packaged and shipped according to the procedures in Key SOP #114, "Sample Handling, Preservation, Packaging, and Shipping."

## 4.0 DATA RECORDING OR MANAGEMENT

(Reserved)

## 5.0 REFERENCES

U.S. Environmental Protection Agency, 1986. *RCRA Groundwater Monitoring Technical Enforcement Guidance Document*. OSWER-9950.1. September 1986.

U.S. Environmental Protection Agency, 1986. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846 3<sup>rd</sup> Edition (with revisions).

U.S. Environmental Protection Agency, 1987. *A Compendium of Superfund Field Operations Methods, Part 1*. EPA/540/P-87/001. December 1987.

U.S. Environmental Protection Agency, 1991. *Compendium of ERT Groundwater Sampling Procedures*. EPA/540/P-91/007. January 1991.

## #105 - CHAIN OF CUSTODY

### 1.0 SCOPE AND PURPOSE

This Standard Operating Procedure (SOP) presents procedures for documenting possession/custody of environmental samples from the time of collection through delivery to the receiving analytical laboratory. At this point, internal laboratory records should document sample custody until final disposition. This SOP also discusses sample identification and the use of chain-of-custody (COC) forms.

Possession of the samples must be traceable from the time each is collected until analysis is completed. To document sample possession, chain-of-custody procedures are followed. Chain-of-custody evidence includes all documentation associated with the sample including the chain-of-custody form, sample label, custody seal, courier's receipt (if applicable), and field notebook.

A sample is under custody if one or more of the following criteria are met:

- It is in possession of the custodian or a designated member of the sampling team;
- It is in plain view, after being in possession;
- It was in possession and is secured against tampering; and,
- It is placed in a designated secure area.

### 2.0 REQUIRED MATERIALS

- Sample container labels;
- Chain-of-custody forms;
- Field notebook;
- Shipping Airbills;
- Locks or Packaging Tape; and,
- Custody seals.

### 3.0 METHODOLOGIES

The Project Manager (or designee) is responsible for ensuring that sample labeling is completed in accordance with this SOP and that chain-of-custody forms are completed for sample shipments. All individuals relinquishing and receiving samples shall sign, date, and record the time on the chain-of-custody forms.

#### Sample Identification

Blank sample labels will be supplied by the analytical laboratory and affixed to the sample container. Sample labels will be completed using waterproof permanent markers or ink. The

labels will be filled out at the time of sample collection by the field sampling personnel. The following identifying sample information will be included on the label:

- Client/Site;
- Sample identification alpha-numeric code;
- Sample collector's initials;
- Date and time (military) of sample collection;
- Analytical method; and,
- Laboratory analysis to be performed.

### **Chain-of-Custody Forms**

Once the sample containers have been filled with the sampled media and properly labeled, they will be prepared for shipment to the receiving analytical laboratory. Coolers containing samples will be accompanied by a chain-of-custody form (see example COC form in Figure 1).

The field team leader (or designee) shall complete a chain-of-custody form for each lot of packaged samples (*e.g.*, cooler). COC forms shall be completed in ink. Any transcription errors shall be corrected by striking the erroneous information with a single horizontal line. The corrected information shall be added immediately adjacent to the strikeout. The sampler should initial the correction.

The following information will be recorded on the COC form:

- Client/Site;
- Name(s) of sampler(s);
- Sample identification alpha-numeric code;
- Date and time (military) of sample collection;
- Type of sample (*e.g.*, soil, groundwater);
- Number of containers per sample location;
- Requested analyses;
- Type of containers and preservatives used;
- Name and address for the completed laboratory reports;
- Name and address for laboratory invoices; and,
- Specific instructions/notes for the laboratory, as necessary.

Any area of the COC, where sample information is not completed, should have a hatched line drawn through to show that this portion of the COC will not be completed.

Each COC will be placed in a waterproof plastic bag and affixed to the underside of the shipping container lid. Samples will be packaged properly for shipment as described in SOP #114, Sample Handling, Preservation, Packaging, and Shipping, and dispatched to the appropriate laboratory for analysis. Shipping containers will be padlocked or otherwise sealed for shipment to the laboratory.

All shipments should be accompanied by the completed Chain-of-Custody Record. The original record will accompany the shipment to the laboratory, and a copy will be retained by the field team leader for the project file. Shipping bills and receipts must be retained as part of the chain-of-custody documentation.

Upon receipt of the samples by the laboratory, the laboratory person assigned to log-in samples will confirm that the shipping container seals are in good condition and have not been disturbed. The original chain-of-custody form is to be signed and dated by the laboratory person logging in the samples. In addition, the receiving laboratory is to inspect each sample and indicate the condition of the sample on the COC. The receiving laboratory is to retain a copy of each chain-of-custody form along with the shipping bill. Internal laboratory chain-of-custody procedures will be followed once samples are logged in by the receiving laboratory.

#### 4.0 DATA RECORDING/MANAGEMENT

As discussed in Section 3.0, information related to tracking environmental samples will be recorded on the COC forms which will be retained in the project files.

#### 5.0 REFERENCES

U.S. Environmental Protection Agency, 1986. *RCRA Groundwater Monitoring Technical Enforcement*

U.S. Environmental Protection Agency, 1986. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846 3<sup>rd</sup> Edition (with revisions).

U.S. Environmental Protection Agency, 1987. *A Compendium of Superfund Field Operations Methods, Part 1*. EPA/540/P-87/001. December 1987.

U.S. Environmental Protection Agency, 1991. *Compendium of ERT Groundwater Sampling Procedures*. EPA/540/P-91/007. January 1991.

**Figure 1**  
**Example Chain-of-Custody Form**



## #106 - FIELD LOGBOOK

### 1.0 SCOPE AND PURPOSE

This Standard Operating Procedure (SOP) presents procedures for proper documentation of site activities with respect to the daily field logbook. Field logbooks are the primary source of documentation for site activities, and serve as legal record of all occurrences during those activities.

### 2.0 REQUIRED MATERIALS

The required materials for maintaining a field log book include a water-resistant, permanently bound notebook and a pen with permanent ink.

### 3.0 METHODOLOGIES

Pertinent information regarding the site and work procedures must be documented. Information recorded in the notebook should be noted with the date and time of entry. The following items are commonly included as logbook entries:

- Name and location of site;
- Date and time of arrival and departure;
- Name of person keeping log;
- Names and affiliations of project personnel;
- Sampling event description; including methodology, sample numbers and volumes, description of samples, date and time of sample collection, and name of collector;
- Prevailing weather conditions;
- Technical measurements and readings;
- Diagrams and sketches;
- Description of equipment used;
- List and descriptions of photographs; and,
- Equipment calibration information.

Information should be recorded in permanent ink for the legal record. The company name, address, and phone number should be entered at the beginning of the log book. The pages of the logbook should be numbered for ease of reference. Blank spaces should be crossed out and initialed. All notes should be written at the time of observation. Changes or deletions should be crossed out with a single line and initialed by the individual making the change. At the end of each field day, the project scientist/engineer or designee should sign and date each page of the notebook on which entries were made to verify the day's activities.



#### 4.0 QA/QC PROCEDURES

At the end of each day of field activities, the individual or individuals maintaining the field log book should review the notes for accuracy and completeness. Corrections, deletions, or additions should be initialed and the time and date should be noted.

#### 5.0 DATA RECORDING AND MANAGEMENT

It is recommended that a running activity log be maintained, indicating the times of activities and observations; recorded data be written in the form of tables with an appropriate title; and that diagrams be included to illustrate pertinent information. Log books should be labeled with the project name, project number, and a consecutive number for cataloging purposes.

#### 6.0 REFERENCES

Environmental Research Center, University of Nevada - Las Vegas, March 1989, Soil Sampling Quality Assurance User's Guide, EPA/600/8-89/046.

Fetter, C. W., 1994, Applied Hydrogeology, Macmillan College Press Publishing Company, New York, New York, 691 p.

U.S. EPA, September 1986, RCRA Ground-Water Monitoring Technical Enforcement Guidance Document, OSWER-9950.1

## #107 SUBSURFACE SOIL SAMPLING

### 1.0 SCOPE AND PURPOSE

This Standard Operating Procedure (SOP) presents procedures for the collection and identification of subsurface samples from soil borings. Soil samples are used to evaluate the physical and/or chemical characteristics of the subsurface. Physical information can be used to define site geologic, hydrogeologic, and geotechnical properties. Chemical data generated from these samples can be used to define the lateral and vertical extent of contaminants in the subsurface.

Samples may be collected *via* a number of techniques, depending upon site conditions and project objectives. These techniques include split-barrel sampling or thin-walled sampling through hollow-stem augers, direct-push sampling *via* Geoprobe or cone-penetration technology, hand auger, test pit excavation, or other methods.

### 2.0 REQUIRED MATERIALS

The following equipment may be required when conducting subsurface soil sampling. However, not all equipment may be needed for any single sampling event.

- split-barrel sampler;
- thin-walled sampler; and/or,
- direct-push sampler.

Sampling devices are often provided by subcontractors.

### 3.0 METHODOLOGIES

#### 3.1 Sample Collection

Subsurface soil samples can be collected using a variety of methods that are generally dependent upon project requirements, intended analyses (*i.e.*, volume of soil required for testing) and site geologic conditions. Common sample collection methods are discussed below.

##### Split-Barrel Sampling

The procedures for this sampling method are presented in the American Society for Testing and Materials (ASTM) Method D1586. The samples collected with this method usually provide a sufficient volume to test some physical parameters, such as grain size distribution, and commonly performed chemical analyses (*e.g.*, VOCs, SVOCs, and metals).

Following each use, the sampler should be washed thoroughly to remove residual soils. If samples are to be submitted for chemical analysis, the sampler should be decontaminated

between samples using a soapy (nonphosphatic) water wash and clean water rinse followed by solvent rinses and/or acid rinses and distilled water rinses as required for the analytes of interest. Split-barrel samples are used to collect soil samples 18 to 24 inches in length from a selected depth interval. Depth intervals will be specified in the project-specific work plan. The sampling depth and the blow counts for each 6-inch interval will be recorded in the field notebook. After removing the sampler from the borehole, these procedures should be followed:

- Note and record the amount of recovery;
- Describe the sample as per ASTM Method D2488; and,

Select representative portion(s) for retention and place in a labeled clean storage jar(s) for subsequent evaluation of physical characteristics or in a laboratory supplied, labeled jar for laboratory chemical analysis.

If samples are to be field screened for volatile organics: (1) the soil core should be screened immediately after the spoon is opened; and/or, (2) a sample should be placed with adequate headspace in a clean glass jar to be screened later for volatile organic chemicals in the headspace, if necessary. If a sample is to be submitted for volatile organic chemical analysis, it is important that exposure time of the soils to the air be kept to a minimum. In addition, samples collected for chemical analysis should be placed on ice in a sample cooler immediately after sampling.

As necessary, the following information should be included in the field notebook:

- Sample depth interval;
- Standard blow counts required for each six-inch penetration;
- Sample recovery;
- Sample description;
- Field screening data; and,
- When samples are collected for laboratory analysis, include the unique sample identification number, the type of analyses requested, and the laboratory where the sample is to be sent.

Excess sample material can be containerized or placed on the land surface as specified in the project-specific work plan. Management requirements for wash water and decontamination water should also be identified in the project-specific work plan.

### **Undisturbed (Thin-Walled) Soil Sampling**

These samples are commonly referred to as "Shelby tube" samples. The procedures for collecting samples by this method are presented in ASTM Method D1587. The method is used to collect samples in conjunction with auger or wet rotary drilling methods, generally for geotechnical testing, but they may be used for chemical analysis as well. These samples are generally collected only from cohesive materials.

Typically, the soil is not removed from the Shelby tube in the field, unless analytical testing is required; the tube ends are sealed with plastic caps and/or wax and the tube sent intact to the testing laboratory. Prior to sending the samples to the laboratory, all residual soil should be removed from the outside of the sampling tube.

The tube should then be prepared for shipment as indicated in ASTM Method D1587. The tube should be labeled as shown in Figure 1, including the following information:

- Job name and number;
- Sample location (soil or well boring number);
- Sample identification;
- Sample interval and the percent recovery;
- Date of sample; and,
- Top and bottom of sample - lines should be drawn around the circumference of the tube, indicating the top and the bottom of the sample with an arrow pointing toward the top.

This information and any descriptive data on sample characteristics should be recorded in the field notebook.

### **Direct-Push Soil Sampling**

The Geoprobe® direct-push soil sampling methodology is described herein, and is considered to be representative of most direct-push soil sampling procedures. Direct-push soil borings are completed by hydraulically pushing a sampling device to the top of the desired depth interval for soil sample collection. The soil sampling device typically consists of a stainless steel sampling tube through which a stainless steel drive point is inserted and attached to a piston stop pin. The steel drive point and piston stop pin prevent soil from entering the sampling device until the desired depth interval is encountered. A dedicated acetate liner for soil containment may be inserted into the sampling device. When the top of the desired sampling interval is encountered, the piston stop pin and stainless steel drive point are removed in order to permit soil to enter the sampling device with the next push of the rods. The rods are then extracted and the sampling device is opened to expose the sampled core of soil, which can then be described and/or containerized.

### **3.2 Sample Identification**

A unique sample identification will be given to each soil sample collected. A precise method for sample identification, based on this generic scheme, should be presented in the project work plan and sampling and analysis plan. One example of a sample identification scheme follows:

The identifier will be composed of three groups of alpha-numeric characters, which will identify (1) the project and/or site; (2) the sample location; and, (3) the sample interval. The three groups should be separated by dashes as in the following example:

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### AL-MW10-SS5

- Project Site (AL): The first two characters of the sample identifier should be a two-character alphabetical code identifying the client and the site. For example, a project for the Allied Gas Company in Lewistown may be identified with the code "AL." A unique project site identifier should be selected by the project manager and be specified the project-specific work plan and the project-specific sampling and analysis plan.
- Sample Location (MW10): The second set of digits should be a combined alphabetical and numerical code that identifies the sample location and location type. The example identifies a soil sample collected during the construction of Monitoring Well 10. Commonly used sample location identifiers include:
  - SB - soil boring;
  - SF - surface soil;
  - TP - test pit; and,
  - MW - monitoring well (if soil samples are collected from a monitoring well pilot borehole)
- Sample Type and Interval (SS5): The third group of characters should be both alphabetical and numerical characters that identify the sample interval. The example given identifies a soil sample collected from split-barrel sample 5. The boring log and field notes should reference the specific sampling interval (indicated numerically), but typically the number indicates the depth in feet below land surface where sampling began. Commonly used sample type identifiers include:
  - SS - split-barrel sample;
  - ST - Shelby tube sample;
  - CB - core barrel sample;
  - CO - composite sample; and,
  - AC - auger cuttings.

"Blind" duplicate samples will be identified in the same way as any other sample, such that it is not identified as a duplicate; however, the source of the duplicate sample should be identified in the field book as such. Data quality samples (matrix spike or matrix spike duplicate samples) should be identified as such with an "MS" or "MSD" code, as appropriate [e.g., AL-MW10-SS5(MS)].

If trip blanks or field blanks are required (these are typically deionized water samples or rinsate water samples collected from soil sampling tools), the sample identification scheme will include TB or FB and a number in the second group. The number should identify the source of the blank and be described in the field notes. A sample type and interval code for blank samples is not required.

## 4.0 DATA RECORDING

All sample identification codes should be clearly identified with the sample description in the field notebook and should be used on the chain-of-custody and analytical request forms.

## 5.0 REFERENCES

American Society of Testing and Materials, 1996. *1996 Annual Book of ASTM Standards*. ASTM Standard D1586: Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils.

American Society of Testing and Materials, 1996. *1996 Annual Book of ASTM Standards*. ASTM Standard D1587: Standard Test Method for Thin-Walled Tube Sampling of Soils.

American Society of Testing and Materials, 1996. *1996 Annual Book of ASTM Standards*. ASTM Standard D2488: Practice for Description and Identification of Soils (Visual-Manual Procedure).

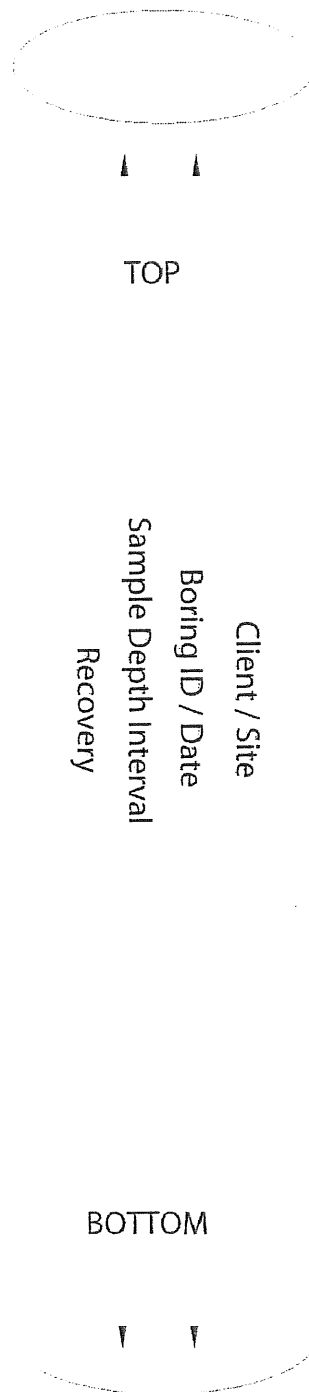


Figure 1. Shelby Tube Marking Requirements

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## #109 - GROUNDWATER LEVEL MEASUREMENTS

### SCOPE AND PURPOSE

This section provides general instructions for the accurate measurement of groundwater levels using various methods/equipment. The methods conform to those presented in American Society for Testing and Materials Method D 4750-87.

### APPLICABILITY

The procedures presented will permit the accurate determination of water levels (depth to water measurements) in wells and piezometers. The data produced can be used in conjunction with well top-of-casing (TOC) elevations to calculate groundwater elevations and subsequently determine groundwater flow gradients and directions, and vertical gradients. The data may also be used to evaluate drawdown in pumping and/or observation wells during aquifer characterization tests.

### DEFINITIONS

**Top-of-Casing (TOC):** The point of the well riser from which all measurements are made and for which the elevation is surveyed. If the TOC is not identified on the well casing, measurements should be taken from the northernmost point on the lip of the riser.

**Depth to Water:** Distance measured from TOC to the water surface in feet (to tenths and hundredths).

### PROCEDURES

Depth to water measurements can be collected using several methods:

- Graduated tape and marker chalk - indirect reading; and,
- Electronic water level indicator (E-tape) - direct reading.

In general, the equipment is not dedicated for use at any one particular site or well and should, therefore, be carefully and thoroughly decontaminated between each use. Decontamination procedures are discussed in SOP No. 115. Equipment may be dedicated to a well or series of site wells if the investigation is of sufficient scope and length to support the additional cost (particularly the E-tape and electronic water level indicator). Substantial contamination (*e.g.*, floating product) in a well may also necessitate the dedication of measuring equipment.



## GENERAL

The measurement for each well should be repeated until two consecutive readings are recorded that are  $\pm 0.01$  foot (this may not be practical during aquifer pump tests). The data will be recorded in the field logbook; for indirect methods, record both measurements—DO NOT PERFORM SUBTRACTION/ADDITION IN YOUR HEAD. All measuring devices will be decontaminated between wells.

## GRADUATED TAPE

A heavy object (plunker or popper) is taped or otherwise attached to the end of a graduated tape (marked to hundredths of a foot). The plunker will help to keep the tape taut while measuring; and, since the tape tends to cling to the inside wall of the well, it will assist in lowering the tape. The first one to two feet of the tape are coated with chalk, and then the tape is slowly lowered down the well. The user will be able to determine that the water surface has been reached by (a) the “plunking” sound made by the weight when the water surface is reached, or (b) the apparent decrease in weight of the tape as the plunker/tape become buoyant in the liquid. After the water surface is encountered, the tape is lowered an additional six inches to a foot and the total length of tape in the well from the TOC is noted and recorded. When the tape is removed from the well, the point at which the chalk is wetted (washed off) is noted and recorded. By subtracting the length of tape that was below the water surface (wetted) from the total tape length extended from TOC, the depth to water can be calculated. It is important that all measurements be recorded and the calculation made from the recorded data. Never make the calculation in your head.

## ELECTRONIC WATER LEVEL INDICATOR OR E-TAPE

E-tapes are constructed of two-strand insulated wire with a heavy metal object attached at the end to act as a weight. When the water surface is encountered, an electric circuit is completed, which is indicated at the surface by activation of a light or buzzer,

Some E-tapes are graduated to 0.05 foot while others are marked only every 5 or 10 feet. If the tape is marked to the nearest 0.05 foot, the depth to water from the TOC is interpolated between the marks and recorded to the nearest 0.01 foot. When the tape is marked only every 5 or 10 feet, the depth at which water is encountered is calculated by marking the length of line extended from TOC at the time of circuit completion and measuring the distance to hundredths of a foot from length marker, and adding or subtracting this distance as appropriate. Record both measurements and perform the calculation in the notebook; do not make the calculation in your head.

## **#110 - DRILLING METHODS FOR SUBSURFACE INVESTIGATIONS AND WELL INSTALLATION**

### **1.0 SCOPE AND PURPOSE**

This Standard Operating Procedure (SOP) presents a brief summary of drilling methods commonly used for completing monitoring wells and test borings. The application and limitations of the following methods are discussed in this section:

- Hollow-stem auger;
- Driven-casing;
- Fluid-rotary;
- Air-rotary;
- Solid-stem auger; and,
- Cable tool.

Test borings are completed to determine both physical and chemical conditions of subsurface soils (SOP #107). Monitoring wells are installed within these borings for the purpose of collecting representative groundwater samples, for measuring water levels to determine groundwater flow direction, and for performing tests to determine physical aquifer characteristics. The drilling method selected for a particular site, well, or borehole depends on subsurface conditions and, in some instances, regulations. In some cases, a combination of drilling techniques is needed to complete a boring when different formations are encountered. For these reasons, the selection of drilling methods should be made in consultation with the Project Manager and Hydrogeology Task Manager.

### **2.0 REQUIRED MATERIALS**

Materials used for drilling and well installations will vary according to the chosen drilling and subsurface sampling methods, and well design and installation methods. Based upon the chosen drilling method, the subcontracted drilling firm will be responsible for providing a drilling rig, support equipment, and trained drilling crew capable of performing the requested subsurface boring, sampling, and well installation activities. Any qualified drilling subcontractor will typically know, based on experience, what equipment will be required for specific situations. It is necessary, therefore, to provide the driller with as much information as possible regarding the requirements and objectives of the drilling program, as well as the subsurface conditions expected to be encountered.

A generalized list of materials and equipment to be utilized by the driller may include the following:

- Drill rig appropriately equipped to advance a borehole of the appropriate diameter, to the appropriate depth, through the anticipated subsurface materials;
- Drilling support equipment capable of safely handling and maneuvering drilling equipment, including auger sections, casings, drilling rods and bits, bailers, pumps, *etc.*;

- Auxiliary compressor (for air rotary/hammer drilling);
- Hydraulic or manual hammers (for split-spoon sampling);
- Various pumps (mud, trash, grout, *etc.*);
- Various hoses for fluids and air;
- Wellhead diverters;
- Cyclone separator;
- Mud tub(s);
- Sampling devices (split-spoon samplers, Shelby tubes, rock core barrels);
- Casing lifts (cables, clamps, hoists);
- Portable water tank, transfer lines, and pump (if necessary);
- Cutting torch and welder;
- High-pressure, hot water washing system (steam genny);
- Decontamination solutions and equipment (buckets, brushes, *etc.*);
- Lifting straps, chains, and cables; and,
- Various wrenches and specialized tools.

In addition to the equipment and material needs of the drilling subcontractor, the geologist, engineer, and/or hydrogeologist overseeing the drilling and construction activities will require particular items to assist in documenting sampling, drilling, and well construction activities. Equipment and materials likely to be used by oversight personnel may include:

- Field notebook;
- Camera and film;
- Marking pens;
- Boring, sampling, and well construction logs;
- Sample jars, coolers, ice, packing tape, and chains-of-custody (if samples are to be submitted for laboratory analyses);
- Sample containers for geotechnical samples;
- Field screening sample containers (glass jars, Ziploc® bags, foil, *etc.*);
- Field screening equipment (PID, FID, pH paper, immuno-assay testing, field GC, *etc.*);
- Mud balance (for measuring grout and mud densities);
- Fine-mesh sieve or strainer (for collecting and washing drill cuttings for identification);
- Weighted tape for measuring borehole depths, and well construction material placement;
- Tape measure and/or ruler;
- Water-level and/or interface probe;
- pH, temperature, specific conductivity, and turbidity meters (for well development documentation);
- Stopwatch;
- Magnifying glass or hand lens;
- Knife;
- Hydrochloric acid;
- Munsell Soil Color and Rock Color Charts;

- Grain-size identification chart;
- Hard hat;
- Safety glasses; and,
- Steel toe boots.

### 3.0 METHODOLOGIES

Drilling methods should be selected after evaluating site subsurface conditions, including available information on contaminant characteristics, and be consistent with the intended data use and goals of the project work plan. Final selection of the drilling method to be used should be based on relative cost, time constraints, and sampling and testing requirements. A detailed discussion of drilling techniques is presented in Driscoll, 1986, Pages 268 to 533, and Aller, *et al.*, 1989, Pages 40 to 143.

An underground utilities clearance must be verified before drilling at any location. A comprehensive discussion of the procedures for locating utilities is contained in Key SOP #121.

#### 3.1 Hollow-Stem Continuous-Flight Augering Method

This method of drilling consists of advancing hollow-stem augers into unconsolidated materials. As the borehole is advanced, cuttings are brought to the surface by the lifting action of the augers. Drill rods with an attached sampler can be passed through the center of the auger section to retrieve soil samples (SOP #107). After drilling has advanced to the desired depth, a monitoring well can be installed inside the auger stem and backfilled as the augers are simultaneously withdrawn from the borehole.

This method is fast and efficient for shallow drilling (less than 100 feet) and permits both sample collection and installation of small diameter wells. Advantages of this type of drilling include:

- Representative soil samples can be retrieved with either split-barrel or thin-wall samplers;
- Water quality sampling can be done while drilling;
- Monitoring well installation can be achieved in most unconsolidated formations;
- The hollow-stem auger can serve as temporary casing for coring rock or advancing a bedrock borehole by other drilling methods; and,
- Varying rig sizes can perform drilling in limited access areas, including indoors, and skid rigs are available for very limited spaces. Also, many firms maintain all-terrain auger rigs.

Disadvantages and limitations of this method of drilling include:

- Augering can only be performed in unconsolidated materials or soft rock; more dense formations will limit capability at depth;
- Preserving sample integrity in heaving formations is a concern;
- Formation invasion by water or drilling mud is a concern when used to control heaving;

- Cross contamination between aquifers can occur where the annular space is not positively controlled by water or drilling mud or surface casing;
- Inside diameter of augers limits the well casing size generally to four inches in diameter or less; and,
- Smearing of formation clays by the lifting action of the augers may seal off the aquifer to be monitored.

### **3.2 Driven-Casing Method**

The driven-casing method consists of alternately driving casing into the ground and cleaning out material within the casing, using a rotary bit and air or potable water to flush out the materials. This method is used in unconsolidated formations or soft caving rock. When the boring is to be used for well installation, the driven casing used should be at least four inches larger in diameter than the well casing to be installed.

Advantages to this method of drilling include:

- Sampling can be conducted while drilling;
- Well installation is easily accomplished;
- Well development procedures are minimal; and,
- Drill rigs used are relatively small and mobile.

Some of the disadvantages include:

- Use restricted to unconsolidated, noncohesive formations;
- Relatively slow advancement of the borehole;
- Depth of the borehole will vary with the size of drill rig, the casing diameter used and the nature of the formations; and,
- Introduction of drilling fluids into the borehole is discouraged by some regulatory agencies.

### **3.3 Fluid-Rotary Drilling Method**

During fluid-rotary drilling, the borehole is drilled by a rotating bit; cuttings are removed by continuous circulation of a drilling fluid as the bit penetrates the formation. The bit is attached to a string of drill rods that transmits the rotating action and drilling fluid from the rig to the bit.

There are a variety of fluids that can be used in conjunction with this drilling method. The usual drilling fluid is water or water mixed with bentonite (referred to as "mud-rotary"). Under some geologic conditions, it may be necessary to add other compounds to the drilling fluid to increase the fluid weight or viscosity. These additions may include inorganic compounds such as barite or organic polymers. For monitoring wells constructed to sample groundwater quality, the use of any organic polymers in the drilling fluid should be avoided and inorganic additions made only if they will not interfere with the groundwater sampling protocol. The Project Manager should be consulted

before a drilling fluid other than clear water is to be used. The decision as to whether drilling fluid additives should be used should be based on consultation with the client and review of any guidance documents used by the lead regulatory agency, if appropriate. Even if an agency is not currently involved with the project, it may be advisable to utilize their method of preference so environmental data and analytical results cannot be questioned at a later date.

There are two general types of fluid-rotary drilling methods: direct circulation rotary drilling and reverse circulation rotary drilling. In direct circulation rotary drilling, the drilling fluid is circulated down through the drill rods, out the bit, and up the annular space to the settling pit at the surface. In the reverse circulation rotary method, the drilling fluid and cuttings move down the annulus and upward inside the drill rod to be discharged into the settling pit. Upon boring completion, clean water should be circulated through the system to remove residual additives from the borehole and facilitate subsequent well development.

Advantages to rotary drilling methods include:

- The ability to advance a hole in most formations at a relatively quick pace;
- Split-barrel samples, Shelby tubes, and rock cores can be obtained;
- Casing may not be needed because the drilling fluids may keep the borehole open;
- They are relatively common methods that are used by water well drillers in most areas; and,
- The open hole can be geophysically logged.

Disadvantages to this method include:

- Formation logging is difficult if split-barrel samples are not taken;
- Drilling fluid reduces formation permeability to some degree, may circulate contaminants, or alter groundwater quality in the vicinity of the well;
- Limited or no information on depth to water and/or occurrence of water-bearing zones is obtainable while drilling;
- Development techniques for wells may be more extensive when compared to other drilling methods;
- Drill rigs are usually large and heavy and need proper access;
- Federal and state regulatory agencies may prohibit the use of this method for some applications because of the addition of fluids in the hole; and,
- Potable water is required for mixing drill fluids. This water should be sampled and the water source should remain the same throughout the program. This method may require a large volume of water. The availability of a potable water source should always be considered in the selection of this method.

### 3.4 Air-Rotary Drilling Methods

This method is similar to fluid-rotary drilling, except that compressed air is used to cool the drill bit and remove cuttings. Two drilling methods that use air as the primary drilling fluid are direct air-rotary and down-the-hole air hammer. Applications of air-rotary methods include:

- Rapid drilling of semiconsolidated and consolidated rock;
- Good quality/reliable formation samples (particularly if small quantities of water and surfactant are used);
- Equipment generally available;
- Allows easy and quick identification of lithologic changes;
- Allows identification of most water-bearing zones; and,
- Allows estimation of yields in strong water-producing zones with short “down time.”

Limitations of this method include the following:

- Surface casing is frequently required to protect the top of the hole from washout and collapse;
- Its use is restricted to semiconsolidated and consolidated formations;
- Samples are reliable but due to small size are difficult to interpret;
- Drying effect of the air may mask low yield water producing zones;
- Air stream may require filtration to prevent introduction of contaminants from the air compressor; and,
- The injected air may modify the chemical or biological conditions of the aquifer in the immediate vicinity of the borehole.

### **3.5 Solid-Stem Continuous-Flight Augering Method**

The solid-stem continuous-flight augering method operates in the same manner as the hollow-stem auger. Practical application of this method is restricted when compared with hollow-stem augers. Sampling is performed by completely removing the augers from the borehole, which may allow the hole to cave in. This method is effective in silty-clayey soils with hole depths limited to about 50 feet. Depth to water is difficult to determine while drilling. This method is ineffective for well installation in loose soils or when drilling below the water table. Applications and advantages include:

- Conducting shallow soils investigations and collecting disturbed soil samples;
- Installing vadose zone monitoring wells (lysimeters);
- Identifying depth to bedrock; and,
- Drill rigs are small and mobile, allowing access where larger rigs cannot operate.

Disadvantages include:

- Soil sample data limited to areas and depths where borehole remains open during auger removal;
- Unacceptable soil samples unless split-barrel or thin-wall samples are taken;
- Monitoring wells cannot be installed in most unconsolidated aquifers because of borehole collapse following auger removal;
- The depth capability decreases as the diameter of the auger increases; and,
- Monitoring well diameter is limited by the auger diameter.

### 3.6 Cable Tool

This method was one of the first mechanized methods to be widely used for drilling deep water wells. The drill hole is advanced using a heavy bit (a 500- to 2,500-pound tool) hung from a steel cable and suspended from a mast. The tool is placed into the hole and successively dropped from 2 to 3 feet above the bottom of the hole. This action pulverizes the rock or soil in the bottom of the hole. The drilling tool is pulled out and a large bailer is used to remove the cuttings; water may be added to aid in the removal of materials in unsaturated conditions. Casing is driven into the ground just behind the advance of the bit. Advantages include:

- Sampling can be conducted during drilling;
- Well installation is easily accomplished, and development is generally minimal;
- Large diameter installations can be completed, which may be valuable if telescoping required;
- Advances through gravels and running sands; and,
- Casing can be used as temporary casing for rock coring.

Disadvantages include:

- Advancement is slowed in more cohesive materials;
- May involve introduction of water into borehole that must be monitored/sampled;
- Use is restricted to unconsolidated materials (*e.g.*, no rock coring can be performed); and,
- Services are not always available through environmental drilling contractors.

## 4.0 DATA RECORDING OR MANAGEMENT

Information to be collected during the completion of a subsurface drilling and monitoring well installation program will include:

- Soil types, thicknesses, and depths;
- Bedrock types, depths, and thicknesses;
- Identification of the presence and extent of subsurface contamination;
- Depths to water-bearing zones, their respective yields, and presence of contamination; and,



- Well construction details.

Recording of the data should be completed in the field at the time of measurement or observation. The field book should be the primary repository for field data and observations (SOP # 106); however, field forms may provide a more suitable format for collecting and analyzing the data.

Soil boring and sampling information may be recorded entirely in the field notebook or on an appropriately designed boring log form and should include, at a minimum, the following information:

- Drill rig make/model, name of drilling subcontractor, and driller's name(s);
- Weather conditions;
- Boring location identification, including physical description of location in reference to site features, and description of surface conditions at location;
- Borehole advancement method (augering - include size, mud rotary, *etc.*);
- Sample number;
- Sample depth;
- Sample time;
- Sample collection method (split-spoon, cuttings, *etc.*);
- Blow counts;
- Recovery (length and percentage);
- Soil color (from Munsell Soil Color Chart);
- Soil texture and physical description (SOP # 107);
- Observations of contamination (field screening results and visual observations);
- Occurrence and estimated yield of water-bearing zones;
- Depth to water at completion of boring; and,
- Any problems or significant events that occurred during drilling and sampling.

Rock boring and coring data recording requirements are similar to those for soil borings. Information may be recorded in either a field notebook or an appropriately designed boring log form and should include, at a minimum, the following data:

- Drill rig make/model, name of drilling subcontractor, and driller's name(s);
- Weather conditions;
- Boring location identification, including physical description of location in reference to site features, and description of surface conditions at location;
- Borehole advancement method (augering - include size, mud rotary, *etc.*);
- Sample number;
- Sample depth;
- Sample time;
- Sample collection method (cuttings, coring - indicate type);
- Recovery (for coring);
- Rock Quality Data (RQD) (for coring) (SOP # 108);
- Rock color (from Munsell Rock Color Chart);

- Description of rock type, texture, fractures, *etc.*;
- Rate of borehole/coring advancement (per foot);
- Observations of contamination (field screening results and visual observations);
- Occurrence of water-bearing zones and their respective yields;
- Depth to water at completion of boring; and,
- Any problems or significant events that occurred during drilling and sampling.

## 5.0 REFERENCES

Aller, L., T.W. Bennett, G. Hackett, R.J. Petty, J.H. Lehr, H. Secoris, D.M. Nielsen, 1989, Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells, National Water Well Association, Dublin, Ohio.

American Society for Testing and Materials, D2488, Standard Recommended Practice for Description of Soils, (Visual-Manual Method).

Driscoll F.G., 1986, Groundwater and Wells, Second Edition, Johnson Division, St. Paul, Minnesota.

## #111 - MONITORING WELL GROUTING TECHNIQUES

### 1.0 SCOPE AND PURPOSE

This Standard Operating Procedure (SOP) provides general reference information and technical guidance on monitoring well grouting techniques. This procedure gives general guidelines only and may be modified by requirements necessary to meet project specific objectives. Selected monitoring well grouting techniques, which can be applied to monitoring well installation, are also presented in this procedure. Grouting consists of filling an annular or other space with an impervious material. The primary reasons for grouting are as follows:

- Preventing water movement between aquifers, for purposes of maintaining water quality and preserving the hydraulic response of the monitored zone(s); and,
- Protecting the well against the entry of water from the ground surface or shallow subsurface zone.

A third, and sometimes important, purpose of grouting is to protect the casing against attack by corrosive waters.

### 2.0 REQUIRED MATERIALS

Acceptable grout mixtures for monitoring well installation include neat cement grout and bentonite/cement grout as defined in this section.

**Neat Cement Grout:** A fluid mixture of Portland cement and potable water of a consistency that can be forced through a pipe and placed as required. This mixture consists of 5.2 gallons of water per 94-pound bag of Type I or Type II Portland cement. When using Type III Portland cement, the mixture is to be 6.3 to 7 gallons of potable water per 94-pound bag of cement.

**Cement/Bentonite Grout:** A mixture of approximately 8.3 gallons of potable water and 5 pounds of bentonite per 94-pound bag of Type I or Type II Portland cement. Powdered bentonite is used to reduce shrinkage and permeability, increase fluidity, and/or control setting time. Potable water must be used for this mixture. The amount of powdered bentonite used in the neat cement grout is approximately 5 percent by weight. For every additional 2 percent of bentonite added by weight, 1.3 gallons of water should also be added for each 94-pound bag of cement.

### 3.0 METHODOLOGIES

There are several methods for monitoring well grouting. In determining the specific grouting requirements for a monitoring well, considerations must be given to existing subsurface geologic and groundwater conditions. The most effective grouting method should be selected by the site hydrogeologist based on the particular site conditions. Selection of the grouting technique and material may be limited by state or local regulations. Consultation with appropriate agencies prior to

beginning grouting activities is advisable. Where applicable, specific techniques to be used should be stipulated in the project work plan.

Prior to grouting, the annular space should always be flushed to assure that the space is open and able to receive the sealing material. This is performed by circulating water or other drilling fluid in the annular space. Grouting should be performed in one continuous operation in which the annular space is filled. Grout containing cement should be placed entirely before the occurrence of the initial set. It is essential that the grout always be introduced at the bottom of the space being grouted such that positive displacement of any water in the annular space occurs.

The grout may be forced into the annular space by suitable pumps or by air or water pressure. Under certain conditions (*i.e.*, when no water exists in the annular space), placement by gravity is practical and satisfactory.

The following sealing and grouting procedure is recommended for most monitoring wells. Following placement of the filter pack, a 2-foot bentonite seal should be placed above the filter pack. Granular bentonite, bentonite pellets, or bentonite chips are suitable for this application. For monitoring wells that are less than 30 feet deep, the bentonite may be dropped directly down the borehole within the annular space. This should be performed gradually and uniformly in order to prevent bridging. In addition, a tamping device should be used to prevent bridging. For monitoring wells that are greater than 30 feet deep, bentonite should be delivered using a tremie pipe. If a bentonite seal is installed in the unsaturated zone, granular bentonite should be used, gradually hydrated with potable water, and allowed to cure prior to grouting.

Grouting of the remaining annular space should be performed using a tremie pipe with side discharge ports, a grout pump, and the neat cement grout or bentonite/cement grout in slurry form. The grout slurry should be pumped to the bottom of the borehole through the tremie pipe which should be kept full of grout for the duration of the procedure. The tremie pipe should be raised slowly as the annular space fills with grout. As the tremie pipe is raised, the discharge ports should be kept submerged within the grout until the desired zone is completely grouted. An annular space of at least 2 inches between the borehole wall and the well casing should exist, and the minimum inside diameter of the tremie pipe should be 1.5 inches.

#### 4.0 QA/QC PROCEDURES

The grouting of any well or piezometer should be performed by a well driller licensed in the state in which the well is located. The grouting activities should also be supervised by a geologist or engineer who is competent in well drilling and construction techniques, and knowledgeable of project specific requirements. The volume of grouting materials used should be monitored to ensure that bridging or borehole collapse did not occur during grout placement. When grouting multiple casings, the grout should be permitted to set for a minimum of 24 hours before drilling is resumed at the well location. The grout should be visually inspected for settling following curing, and additional grout should be added, as necessary, to raise the grout to the desired elevation.

## 5.0 DATA RECORDING AND MANAGEMENT

The supervising geologist / engineer should record the following information:

- Types and quantities of grouting materials;
- Grouting technique;
- Degree of grout settling; and,
- Interval grouted below ground surface.

## 6.0 REFERENCES

Driscoll, F. G., 1986, Groundwater and Wells, Johnson Division, St. Paul, Minnesota.

New Jersey DEP, May 1992, Field Sampling Procedures Manual.

Ohio EPA, February 1995, Technical Guidance Manual for Hydrogeologic Investigations and Ground Water Monitoring.

U.S. EPA, September 1986, RCRA Ground-Water Monitoring Technical Enforcement Guidance Document, OSWER-9950.1

## #112 - WELL DEVELOPMENT

### 1.0 SCOPE AND PURPOSE

This Standard Operating Procedure (SOP) presents methods for developing monitoring wells or extraction wells following installation and prior to use for data acquisition (e.g., groundwater sampling, aquifer testing). Some of these procedures may also apply to well purging conducted prior to collection of water quality samples. However, development should not be confused with purging, the purpose of which is to evacuate the monitoring well of stagnant water which may not be representative of the aquifer.

Monitoring well development and/or rehabilitation are necessary to ensure that complete hydraulic communication is made and maintained between the well screen and the water-bearing formation. Development is necessary after original installation of a monitoring well to: (1) reduce the compaction and mixing of grain sizes produced during drilling, (2) increase the porosity and permeability of the artificial filter pack by removing the finer grain-size fraction introduced near the screen by drilling and well installation, and (3) remove any drilling fluids or mud that cake the sides of the borehole or that may have invaded the adjacent natural formation, thereby reducing the well efficiency. As a result, well development is typically more rigorous than well purging.

This procedure also applies to rehabilitation of monitoring wells in which siltation has occurred. After a well has been in place for some period of time, the well depth may decrease due to accumulation of fine soil particles (siltation), and rehabilitation will be necessary to reestablish complete hydraulic communication with the aquifer.

### 2.0 REQUIRED MATERIALS

The following equipment may be required when performing well development. Not all equipment may be required, depending on the well development method used.

- Surge block;
  - appropriate pump (centrifugal pump, submersible pump, or bladder pump);
  - bailers and bailer cord;
  - compressed gas source and air discharge line;
  - water discharge line;
  - storage containers;
  - water level probe and/or oil-water interface probe;
  - turbidity meter;
  - copy of the well construction diagram; and,
  - temperature/pH/conductivity meter.

The various specific development procedures discussed in Section 3.2 identify the different types of equipment which may be used to develop monitoring wells or extraction wells. Exact equipment

needs will be specific to the monitoring well and will depend upon the diameter of the well, the depth to water, and other factors such as project objectives and intended use of the well.

### **3.0 METHODOLOGIES**

#### **3.1 General Well Development Procedures**

1. The depth to water in the well is measured in accordance with KEY SOP #116. The well is also checked for the possible presence of NAPLs by the procedures described in KEY SOP #116. The total depth of the well should be measured with a weighted tape and the result compared to the original depth reported in the field notes.
2. If necessary, water is caused to move in and out through the monitoring well screen to move silt and clay particles out of the filter pack around the well screen and into suspension within the well. Water movement is affected using a surge block, bailer, or compressed air. In some situations, pumping water may result in satisfactory development.
3. The sediment-laden water is removed from the monitoring well using a pump, bailer, or air compressor (NOTE: If compressed air is used, a filter must be installed on the compressor to prevent introduction of oil into the well from the compressor). The minimum volume of water (e.g., three casing volumes) which must be removed during development is usually specified in the project work plan. In practice, development of the well is continued until the water removed is essentially free of suspended silt and clay particles, to the extent practicable. In some aquifers, it may not be possible to remove all suspended solids regardless of the extent of development activities. The supervising hydrogeologist is ultimately responsible for the determination that the well has been sufficiently developed and that development can be terminated.
4. Field measurements (pH, specific conductance, temperature, and turbidity) can be taken as a confirmation of sufficient development. Adequate development can be verified by stable readings of these field parameters.

#### **3.2 Specific Well Development Procedures**

The appropriate development method will be selected for each project on the basis of the specific circumstances, objectives and requirements of that project. Further, some agencies have developed comprehensive guidelines for groundwater monitoring and subsurface investigation procedures. The provisions of this SOP will be adapted to these project-specific requirements in the project work plan. The work plan will specify the well development method(s) to be used and the rationale, including trade-offs associated with the nature of the aquifer formation, analytical objectives, well use, and client or agency requirements.

Aside from agency requirements, the criteria for selecting a well development method include well diameter, total well depth, static water depth, screen length, the intended well use, and the type of geologic materials in the aquifer.

The limitations, if any, of each specific procedure, are discussed in each of the following procedure descriptions.

### **Specific Procedure: Surging**

A surge block consists of a rubber (or leather) and metal plunger attached to a rod or pipe of sufficient length to reach the bottom of the well. Well drillers usually can provide surge blocks for large diameter wells (greater than 6 inches). Surge blocks for smaller diameter wells can be constructed easily of materials readily accessible in any hardware store. A recommended design is shown in Figure 1. Surging alone will not cause sufficient well development; however, surging used in conjunction with groundwater removal *via* pumping, bailing, or air-lifting effectively develops most monitoring and extractions wells.

The procedure to be followed when using the surge block is:

1. Construct a surge block using the design in Figure 1 as guidance. Specific materials will depend upon the diameter of the well to be developed. The diameter of the plunging apparatus must be sufficient to force the groundwater in the well out through the well screen, and the rods must be of sufficient length to reach the bottom of the monitoring well.
2. Insert the surge block into the well and lower it slowly to the level of static water. Start the surge action slowly and gently above the well screen using the water column to transmit the surge action to the screened interval. A slow initial surging, using plunger strokes of 3 to 5 feet, will allow material which is blocking the well screen to disengage from the screen and become suspended.
3. After a number (5 to 10) of surge strokes, remove the surge block and purge the well using a pump or bailer. The returned water should be heavily laden with suspended fine particles. As development continues, slowly increase the depth of surging to the bottom of the well screen. For wells with long screens (greater than 10 feet) surging should be undertaken along the entire screen length in short intervals (2 to 3 feet) at a time.

Continue this cycle of surging and pumping/bailing until well development is complete.

### **Specific Procedure: Pumping**

Groundwater pumping is necessary to remove large quantities of sediment-laden groundwater from a well after using the surge block. In some situations, pumping is performed without surging. Since the primary purpose of well development is to remove suspended solids from a well, the pump must be capable of moving some solids without damage. The preferred type of pump is a centrifugal



pump because of its ability to pump solids. However, a centrifugal pump will work only where the depth to groundwater is less than approximately 25 feet. If depth to groundwater is too great, a positive-displacement pump such as a submersible or bladder pump will be necessary.

Well development using a pump is more effective in those wells that will yield water continuously. Effective development may not be accomplished if the pump has to be shut off to allow the well to recharge.

The procedure to be followed for well development *via* pumping is:

1. Set the intake of the pump in the center of the screened interval of the monitoring well.
2. When appropriate, use the pump to fill the monitoring well to the top of the casing and allow the water level to decline to the static level, thereby forcing water back into the formation. This action will cause water to exit the well screen and reduce the bridging of materials caused by water flowing in one direction through the well screen while pumping.
3. The water used to fill the monitoring well should be the same water removed from the well during the previous pumping cycle. The sediment previously pumped from the well must be removed from the water prior to re-introduction to the well. A steel drum can be used as a sediment-settling vessel.

Continue pumping water out from the well until well development is complete.

#### **Specific Procedure: Bailing**

A bailer is an effective tool for development of small diameter monitoring wells where removal of only a relatively small volume of water is required for development. A bottom-filling bailer can also be used to remove sediment-laden water from wells after using the surge block.

The procedure to be followed for well development *via* bailing is:

1. Lower the bailer into the screened interval of the monitoring well.
2. Using long, slow strokes, raise and lower the bailer in the screened interval simulating the action of a surge block.
3. Periodically bail standing water from the well to remove fine particles drawn into the well.

Continue surging the well and removing water from the well until well development is complete.

### **Specific Procedure: Air-lifting**

Air-lifting with compressed air can be used to both surge and purge a monitoring well. An air compressor is used to inject gas at the bottom of the water column, driving sediment-laden water to the surface. Compressed air can also be used for "jetting" - a process by which the air stream is directed at the slots in the well screen to cause turbulence (thereby disturbing fine materials in the adjacent filter pack). Compressed air is not limited to any depth range.

The hose or pipe which will be installed in the well for jetting should be equipped with a horizontal (side) discharge nozzle and one or more small holes in the bottom of the hose to enhance the lifting of sediment during jetting.

Provisions must be made for controlling the discharge from the wells. This is generally accomplished by attaching a "tee" discharge to the top of the casing and providing drums or other containers to collect the discharged water.

Although the equipment used to develop a well using this method is more difficult to handle and use, well development using compressed air for jetting the well screen is considered to be a very effective method. This method also is the most generally applicable because it is not limited by well depth, well diameter, or depth to static water.

The procedure to be followed for well development *via* air-lifting is:

1. Lower the gas line from the gas cylinder into the well, setting it near the bottom of the screened interval. Install the water discharge control equipment at the well head.
2. Set the gas flow rate to allow continuous discharge of water from the well. The discharge will contain suspended clay and silt material.
3. At intervals during gas-lifting, especially when the discharge begins to contain less suspended material, shut off the air flow and allow the water in the well to flow out through the screened interval to disturb any bridging that may have occurred. Restart the gas flow when the water level in the well has returned to the pre-development level.
4. Jetting of the screened interval also can be done during gas-lifting of water and sediment from the well. This is accomplished by using a lateral-discharge nozzle on the gas pipe or hose and slowly moving the nozzle along the length of the screened interval. Jetting should be done beginning at the bottom of the well screen and moving slowly upwards along the screened interval. To enhance gas lifting of sediment, occasionally raise the discharge nozzle into the cased portion of the well and discharge sediment-laden water.

Continue air-lifting and/or jetting until well development is complete.

## 4.0 QA/QC MEASURES

Development of new monitoring wells or extraction wells is the responsibility of the hydrogeologist involved in the original installation of the well. The geologist may, in fact, contract with the well driller to develop new wells under the geologist's guidance and oversight. If the project involves sampling of existing monitoring wells, the hydrogeologist is also responsible for verifying the original well construction details and determining if a previously installed well requires rehabilitation.

### Monitoring Well Construction Details

A copy of the original well construction diagram for the well to be developed must be obtained from the Project Manager. This form provides critical information regarding the construction of the monitoring well and must be in the possession of the well development crew so that pertinent well construction details, such as total well depth and screened interval, are known.

### Equipment Decontamination

All equipment which contacts development water or is placed inside a well should either be dedicated for use on only a single monitoring well or should be decontaminated, in accordance with KEY SOP #115, to prevent cross-contamination between monitoring wells or recovery wells.

### Successful Development Criteria

A well has been successfully developed when one or more of the following criteria are met:

- The well yields clear, sediment-free water to the extent possible;
- field measurements of pH, specific conductance, temperature, and turbidity have stabilized;
- aquifer response and well yield are observed to be representative of the type of lithologic formation over which the well is screened; and/or,
- the well is free of sediment, the measured well depth is consistent with the well construction diagram, and that depth is maintained for some extended period of time.

### Development Water Management

The work plan must specify the means for managing development and purge water. At active facilities, an active water treatment facility may be available for management of development and purge water. Otherwise, the water should be containerized until analytical results are available to determine the applicable management options.

## 5.0 DATA MANAGEMENT

If required, a Well Development Form (Figure 2) will be completed by the geologist or hydrogeologist conducting the development. In addition, a Field Log Book should be maintained detailing any problems or unusual conditions which may have occurred during the development process.

All documentation will be retained in the project files following completion of the project.

## 6.0 REFERENCES

American Society of Testing and Materials, 1996. *1996 Annual Book of ASTM Standards*. ASTM Standard D5521: Standard Guide for Development of Ground-Water Monitoring Wells in Granular Aquifers.

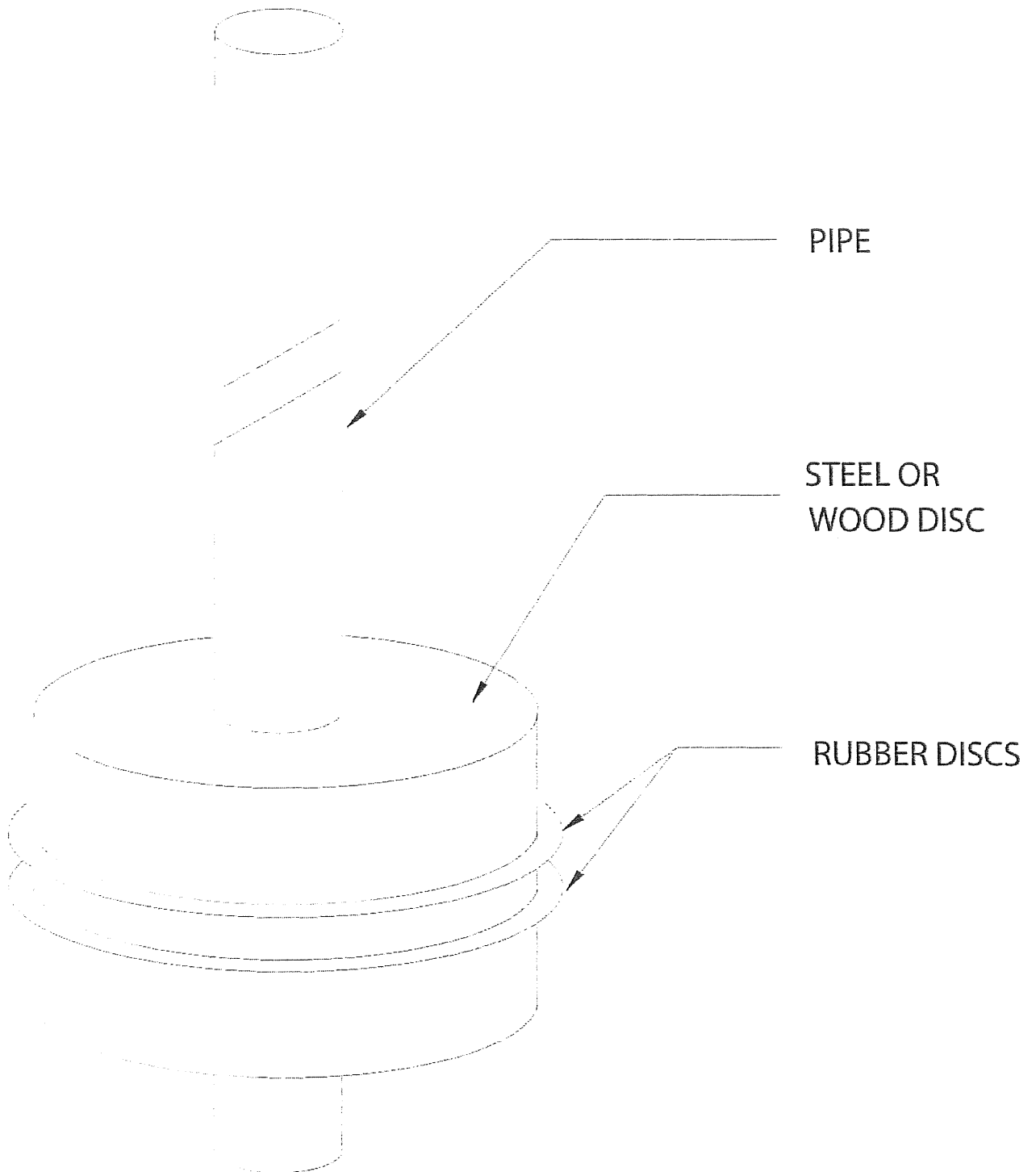
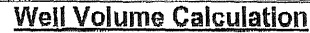


Figure 1. Example Surge Block Design

**Figure 2. Well Development Form**

Project Name:  
Project No.:  
Site Location:  
Purge/Development Method:  
(e.g. balling, pumping, surge block, etc.)  
Notes:

Total Depth of Well (ft-TOC<sub>i</sub> (1)): \_\_\_\_\_  
 Water Level (ft-TOC<sub>i</sub> (1)): \_\_\_\_\_  
 Date of Measurement: \_\_\_\_\_  
 Time of Measurement: \_\_\_\_\_  
 Measurement of TOC<sub>i</sub> (1) to TOC<sub>o</sub> (2): \_\_\_\_\_



<u>Diameter (in)*</u>	<u>Gallons per Foot*</u>
-----------------------	--------------------------

1 Well Volume = \_\_\_\_\_ gallons

Gallons Per Foot[illegible]

Reviewed By / Date:

## #114 - SAMPLE HANDLING, PRESERVATION, PACKAGING, AND SHIPPING

### 1.0 SCOPE AND PURPOSE

This Standard Operating Procedure (SOP) describes the procedures associated with the handling, preservation, packaging, and shipment of environmental samples for laboratory analysis or testing. Environmental samples may consist of air, groundwater, surface water, sediments, soil, non-aqueous phase liquid (NAPL), and/or sludges. The objective of sample preparation, handling, packaging, and shipping protocols is to develop standard procedures which will preserve the integrity of the samples and minimize the potential for sample tracking errors, sample spillage or leakage, and/or sample container breakage. The field team leader is responsible for the implementation of the sample handling, preservation, packaging, and shipping requirements outlined in the project-specific sampling and analysis plan (SAP).

### 2.0 REQUIRED MATERIALS

Required materials may include the following:

- Sample containers (preserved, as necessary);
- Sample bottle labels;
- Chain-of-Custody forms;
- Sample cooler;
- Bubble wrap or other suitable packing material;
- "Blue Ice" (*i.e.*, reusable, freezable ice packs) or sealed bagged ice;
- Shipping bills (Federal Express, Airborne, etc.);
- Packaging tape; and,
- Zip lock plastic bags.

### 3.0 METHODOLOGIES

#### 3.1 Sample Handling

##### Sample Containers

Sample containers and appropriate preservatives (where necessary) will be supplied by the analytical laboratory. After the respective sample containers have been filled with appropriate sample media and preserved as necessary, samples will be properly identified using sample container labels, and the samples will be stored at an appropriate temperature (usually <4°C) to preserve the integrity of the samples.

##### Sample Preservation



Preservatives will be supplied by the laboratory. Where possible, preserved containers should be supplied by the lab. Common preservatives include hydrochloric acid (HCl), sulfuric acid (H<sub>2</sub>SO<sub>4</sub>), nitric acid (HNO<sub>3</sub>), or sodium hydroxide (NaOH). Samples will be preserved in accordance with EPA protocol specified in SW-846 or the project specific protocols outlined in the quality assurance project plan (QAPjP). Use of the preservatives will be noted on the COC for each particular sample and analytical parameter.

### Sample Labels

Blank sample labels will be supplied by the analytical laboratory and affixed to the sample container. Sample labels will be completed using waterproof permanent markers or ink. The labels will be filled out at the time of sample collection by the field sampling personnel. The following identifying sample information will be included on the label:

- Client/Site;
- Sample identification alpha-numeric code;
- Sample collector's initials;
- Date and time (military) of sample collection;
- Analytical method; and,
- Laboratory analysis to be performed.

### Chain-of-Custody Forms

A chain-of-custody (COC) record will be established and maintained to document sample possession from the time of collection until receipt by the laboratory. Once samples are received by the laboratory, they will be handled under the laboratory internal COC procedures. Field sampling personnel will initiate a COC record by recording the following minimum data as the samples are collected:

- Client/Site;
- Name(s) of sampler(s);
- Sample identification alpha-numeric code;
- Date and time (military) of sample collection;
- Type of sample (e.g., soil, groundwater);
- Number of containers per sample location;
- Requested analyses;
- Type of containers and preservatives used;
- Name and address for the completed laboratory reports;
- Name and address for the laboratory invoices; and,
- Specific instructions/notes for the laboratory, as necessary.

Sample COC forms will be placed in waterproof plastic bags and taped to the underside of the cooler lids. Sample COC forms will generally be supplied by the subcontracting analytical laboratory.

Subsequently, at each change of possession, the COC record will be signed by the person relinquishing the samples and by the person receiving the samples. The date and time of the transfer of possession of the sample will be recorded on the COC form; this occurs when the samples are transferred from the sampling personnel to the courier and when the samples are received at the analytical laboratory. Sample COC forms shall be completed in ink. Any transcription errors shall be corrected by striking the erroneous information with a single horizontal line. The correct information will be added immediately adjacent to the strikeout. The sampler should initial the correction. (Refer to SOP #105 for additional information).

### 3.2 Sample Packaging and Shipping

All samples will be transported to the analytical laboratory in durable, waterproof, secured metal or plastic coolers. Sample coolers will generally be supplied by the laboratory. All samples will be packaged very carefully to prevent sample breakage. Samples will be shipped *via* overnight carrier (e.g., Federal Express, Airborne, United Parcel Service) or hand delivered to the analytical laboratory, generally within 48 hours of collection. However, project specific protocols will be checked to assure that specified sample holding times are not exceeded in the event that samples are not shipped on the same day that they were collected. Additionally, the sample security and preservation must be maintained if samples are not to be transported immediately to the laboratory. The following procedure should be followed for packaging samples for shipment to the laboratory for testing and/or analysis.

1. Place plastic bubble wrap matting or suitable material over the base and bottom corners of each cooler or shipping container.
2. Obtain a chain-of-custody record (similar to the example shown in Figure 1) and enter all the appropriate information as discussed above. Chain-of-custody records will include complete information for each sample. One or more chain-of-custody records shall be completed for each cooler or shipping container as needed to manifest each sample.
3. Place bubble wrapping or other suitable material around glass bottles and place standing upright on the base of the cooler, taking care to leave room for packing material and ice or equivalent. Rubber bands or tape may be used to secure wrapping completely around each sample bottle.
4. Place additional bubble wrap and/or Styrofoam pellet packing or equivalent material throughout the voids between sample containers within each cooler.
5. Place cold packs or ice in heavy duty "zip-lock" type plastic bags, completely close the bags, and distribute such packages over the top of the samples. Add additional bubble wrap and/or Styrofoam pellets or other packing materials to fill the balance of the cooler or container.

6. If shipping the samples by express, courier, or delivery service, sign the chain-of-custody record thereby relinquishing custody of the samples. The date and time of custody transfer should be recorded on the chain-of-custody form. The custody transfer should be documented when directly transferring custody to a receiving party or when transmitting to a shipping service for subsequent receipt by the analytical laboratory. The shipping service should not be asked to sign chain-of-custody records.
7. Remove the last copy from the chain-of-custody record and retain with the field records. Place the original and remaining copies in a "zip-lock" type plastic bag and tape the bag to the underside of the lid of the cooler or shipping container.
8. Close the top or lid of the cooler or shipping container and with another person gently rotate the container to verify that the contents are packed so that they do not move. Improve the packaging if needed and reclose.
9. Packaging tape should be wrapped entirely around the sample shipping containers. A minimum of two full wraps of packaging tape will be placed in at least two places on the cooler or shipping container. Some project-specific QAPjPs may require custody seals be placed on the sample shipping containers. Sign and date the chain-of-custody tape.
- 10a. When transporting samples by automobile to the laboratory, and where periodic changes of ice are required, the cooler should only be temporarily closed so that reopening of the cooler can be easily performed. In these cases, chain-of-custody will be maintained by the person transporting the samples and chain-of-custody tape need not be used. If the cooler is to be left unattended, then chain-of-custody procedures should be implemented.
- 10b. If shipment is required, transport the cooler to an overnight express package terminal or arrange for pickup. Obtain copies of all shipment records as provided by the shipping service.
11. Upon receipt of the samples, the analytical laboratory will open the cooler or shipping container and will sign "received by laboratory" on each chain-of-custody form. The laboratory will verify that the chain-of-custody tape has not been broken previously and that the chain-of-custody tape number corresponds with the number on the chain-of-custody record. The analytical laboratory will then forward the back copy of the chain-of-custody record to the sample collector to indicate that sample transmittal is complete.

#### 4.0 QUALITY CONTROL

Quality control samples such as rinsate blanks and duplicates will be specified by the project QAPjP. A sample jar containing water should be sent as a temperature blank with each sample shipment requiring temperature preservation to ensure proper temperature is maintained. Also, a trip blank, provided by the laboratory will accompany shipments with samples intended for volatile organic chemical (VOC) analysis.

#### 5.0 DATA RECORDING/MANAGEMENT

The documentation for supporting the sample handling, preservation, packaging and shipping will consist of chain-of-custody records, shipping records laboratory reports. In addition, a description of sample packaging procedures will be written in the Field Log Book. All documentation will be retained in the project files.

#### 6.0 REFERENCES

U.S. Environmental Protection Agency, 1986. *RCRA Groundwater Monitoring Technical Enforcement Guidance Document*. OSWER-9950.1. September 1986.

U.S. Environmental Protection Agency, 1986. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846 3<sup>rd</sup> Edition (with revisions).

U.S. Environmental Protection Agency, 1987. *A Compendium of Superfund Field Operations Methods, Part 1*. EPA/540/P-87/001. December 1987.

U.S. Environmental Protection Agency, 1991. *Compendium of ERT Groundwater Sampling Procedures*. EPA/540/P-91/007. January 1991.

## #115 - EQUIPMENT DECONTAMINATION

### 1.0 SCOPE AND PURPOSE

This Standard Operating Procedure (SOP) describes methods for the decontamination of field equipment that may come into contact with sample media during a sample collection task. Equipment decontamination is performed as a quality assurance measure to mitigate the potential for cross-contamination of samples from the equipment, which can lead to non-representative sample data.

### 2.0 REQUIRED MATERIALS

Decontamination agents may include: ALCONOX, LIQUINOX or other phosphate-free biodegradable detergent solutions, tap water, distilled/deionized water, nitric acid, methanol, isopropanol, acetone or other appropriate solvent as specified in the site investigation work plan. Additional required materials include:

- X Personal protective equipment (defined in project Health and Safety Plan);
- X Chemical-free paper towels;
- X Disposable gloves;
- X Storage containers, such as drums, boxes, plastic bags;
- X Cleaning containers: plastic buckets, galvanized steel pans, plastic (nalgene or equivalent) upright cylinder;
- X Cleaning brushes;
- X High pressure water or steam generator (if necessary);
- X Plastic sheeting;
- X Plastic water storage containers; and,
- X Containers for storage and distribution (*i.e.*, squirt bottles) of cleaning agents (must be chemically compatible with the solvent or solution).

### 3.0 METHODOLOGIES

#### 3.1 General Concepts

Where feasible, all sampling equipment should be cleaned prior to use and dedicated to one sampling location for each sampling event, to minimize the need for cleaning equipment in the field. In some instances, the use of dedicated sampling equipment may not be a practical option, depending on the scope of the project.

In general, decontamination is accomplished by manually scrubbing, washing, or spraying equipment with one or more of the following: detergent solutions, tap water, distilled/deionized water, steam, acids, or solvents. Equipment can be allowed to air dry after being decontaminated or may be wiped dry with chemical-free paper towels, if immediate use is necessary.

The field decontamination methods and agents are to be determined on a project-specific basis and should be stated in the project plans.

#### 3.2 Handling of Decontamination Fluids

In many instances, the frequency of equipment use dictates that decontamination be accomplished in the field. All cleaning solutions and other materials generated during equipment decontamination should be containerized and stored in a central location so as to maintain control over the quantity of materials used or produced throughout the sampling event. Materials generated during decontamination such as liquids, soiled rags, gloves, *etc.*, should be managed as specified in the project plans and/or in accordance with regulatory requirements.

#### 3.3 Health and Safety Considerations

Decontamination procedures may involve:

- X Potential exposure to constituents within the medium being investigated or solvents employed; and,
- X Physical hazards associated with the operation of the decontamination equipment.

When decontamination is performed on equipment which has been in contact with the constituents of interest or when the quality assurance objectives of the project require decontamination with chemical solvents, the measures necessary to protect personnel should be addressed in the Health and Safety Plan. The Health and Safety Plan must be approved by the project Health and Safety Officer before work commences, must be distributed to all personnel performing equipment decontamination and must be adhered to as field activities are performed. Material Safety Data Sheets for any solvents stored or used on-Site should be available at the Site.

### 3.4 Equipment Decontamination Planning Considerations

Decontamination methods, solutions, and frequencies must be considered and addressed during the formulation of a decontamination strategy, and should be outlined in the project plans. Each are dependent on site logistics, site-specific parameters of interest, the nature of the sample media, and the objectives of the study.

- X There are several factors which should be considered when deciding upon a decontamination solution or solvent:
- X The solution or solvent should not contain any of the analytes of interest;
- X The solvent or solution must be effective at removing the constituents of interest;
- X The solvent must be relatively stable so that it can be handled and stored in the field without
- X special handling requirements;
- X All sampling equipment must be resistant to the solvent or solution; and,
- X Regulatory agencies may have specific requirements regarding decontamination solvents.

Methanol, acetone, and hexane are typical solvents of choice for equipment decontamination for general organic analyses. A 10% nitric acid and deionized water solution is the typical solvent of choice for sampling equipment decontamination for general metals analyses. If used on metal equipment, nitric acid may corrode the metal and lead to the introduction of metals to the collected samples. If it is necessary to use metal sampling equipment to collect samples for metals analysis, consideration of the aforementioned should be included during the evaluation of field and laboratory QA/QC samples.

Decontamination should be performed far enough away from the source of contamination so as not to be affected by the source, but close enough to the sampling site to keep decontaminated equipment handling to a minimum.

If heavy equipment, such as drill rigs or backhoes, are to be decontaminated, then a central decontamination station should be considered. Power may be required to run steam generators or high pressure water pumps. A potable water source may also be necessary. The construction of a suitable temporary structure to contain sprays and splashes may be necessary. Rinse and wash solutions should be collected and contained until the materials are characterized to identify appropriate management options, or, if available and appropriate, conveyed directly to an on-Site treatment facility for management.

Depending on the nature of the sample media or the solvents utilized, it may be necessary to collect, contain, and manage all particulate matter and wash solutions. If containment is necessary, it may be achieved by performing the decontamination in large galvanized tubs or over plastic sheeting.

### 3.5 General Equipment Decontamination Procedures

All sampling equipment must be decontaminated before use to ensure that contaminants have not been introduced to the sample during the sampling process through contact with the sampling device.

Heavy equipment such as trucks, drilling rigs and backhoes should be decontaminated upon arrival at the site to prevent the introduction of road chemicals or constituents from a previous site. Monitoring well riser pipes, screens and drilling augers must also be decontaminated, as appropriate, to prevent the introduction of constituents.

Unless the decontaminated sampling devices are to be used immediately, they should be wrapped in aluminum foil, shiny side out, and stored in a designated "clean" area. Field equipment can also be stored in plastic bags to eliminate the potential for contamination. Larger size equipment, such drill rods, augers, backhoe buckets, etc. need not be wrapped or covered. This equipment should be stored on horses or otherwise, kept from storage directly on the ground surface. Field equipment should be inspected and decontaminated prior to use if the equipment has been stored for long periods of time.

If specific procedures are not stated in the project plans, the standard procedures specified herein should be followed.

- Determine from the project plans the method of containment for the particulate and wash solution generated during decontamination. Typically, smaller equipment will be decontaminated in a plastic or galvanized tub. The brush and container used for the decontamination process should be new or decontaminated prior to use.
- Remove all solid particles from the equipment or material by brushing and then rinsing with available tap water. This initial step is performed to remove gross materials. Depending on the size of the equipment being decontaminated, this step may be preceded and/or followed by a steam or high pressure water rinse to remove solids and/or residual oil or grease.

### Decontamination of Equipment for Organic Analyses

- Wash the equipment or sampler with ALCONOX, LIQUINOX, or other phosphate-free detergent solution.
- Rinse with tap water until all detergent and other residue is washed away. Rinse again, if necessary, or repeat previous steps as necessary.



- Rinse with methanol or other appropriate solvent. The solvent to be used should be specified in the project plans.
- Rinse with distilled or deionized water to remove any residual solvent.
- Allow the equipment or material to air dry in a clean area or wipe with chemical-free paper towels before use.

### Decontamination of Equipment for Metals Analyses

- Add a 10% nitric acid wash to the procedures listed for organic analyses prior to the final rinse with distilled or deionized water.
- Include a triple deionized water final rinse.

**Decontamination of Submersible Pumps** *(Note: This procedure does not apply to dedicated submersible pumps which have been permanently installed in groundwater extraction wells.)* This procedure will be used to decontaminate submersible pumps before and between groundwater sample collection points, as well as the end of each day of use.

- During decontamination, the submersible pump will be placed on a clean surface, such as a new plastic sheet.
- When removing the submersible pump from each well, the power cord and discharge line will be wiped dry using chemical-free disposable towels. Should the pump be fitted with a disposable discharge line, disconnect the line for proper disposal.
- Clean an upright plastic-nalgene cylinder first with a methanol, 10% nitric acid, or other specified solvent and then a distilled/deionized water rinse, wiping the free liquids after each.
- For reversible pumps, reverse the pump to backwash all removable residual water present in the pump tubing. The pump should be shut off as soon as intermittent flow is observed from the reverse discharge.
- Rinse the stainless steel submersible down hole pump section with a detergent solution followed by a water rinse and the specified solvent.
- Place the submersible pump section upright in the cylinder and fill the cylinder with tap water, adding 50-100 ml of specified solvent for every one liter of water.
- Activate the pump in the forward mode, withdrawing water from the cylinder.

- Continue pumping until the water in the cylinder is pumped down and air is drawn through the pump. At this time air pockets will be observed in the discharge line. Shut off the pump immediately.
- Remove the pump from the cylinder and place the pump in the reverse mode to discharge all removable water into a disposal container.
- Using the water remaining in the cylinder, rinse the sealed portion of the power cord and discharge tube by pouring the water carefully over the coiled lines.
- On reaching the next monitoring well, place the pump in the well casing and wipe dry both the power and discharge lines with a chemical-free paper towel as the pump is lowered.

### Decontamination of Heavy Equipment

- Upon arrival and prior to leaving a sampling site, all heavy equipment such as drill rods, bits, augers, and backhoe buckets should be thoroughly cleaned. This can be accomplished in two ways, steam cleaning or high pressure water wash and manual scrubbing.
- Consult the project plans for instruction on the location of the decontamination station and the method of containment of the wash solutions. Depending on the scope of the project, it may be necessary to construct a suitable pad with draining capabilities and walls, or other suitable temporary structure, to contain splashes and sprays. A water supply and power source would also be required.

## 4.0 QA/QC PROCEDURES

Quality control checks and acceptance criteria are dependent on site-specific requirements designed to achieve the objectives of the study. These checks shall be determined on a project-specific basis and should be outlined in the project plans.

### Field QA/QC Samples

General guidelines for QA/QC samples collected to verify effective decontamination procedures typically include:

- X Rinseate Blanks - A rinseate blank is obtained by passing analyte-free, distilled, deionized water over or through a decontaminated sampling apparatus and collecting the water in an appropriate container for analysis of the constituents of interest for the study. This blank is used to assess the effectiveness of the decontamination procedures. The frequency of rinseate blank collection is typically listed in the project-specific plans or recommended in regulatory guidance manuals.

## 5.0 DATA RECORDING AND MANAGEMENT

Documentation of decontamination and QA/QC aspects of confirming effective decontamination is accomplished by recording information as follows.

### 5.1 Field Notebook Entries

- X Equipment decontaminated;
- X Solvents used, if any;
- X Notable circumstances, if any;
- X Identification of field QA/QC samples;
- X Method of field QA/QC sample collection; and,
- X Date, time, and location of QA/QC sample collection.

### 5.2 QA/QC Samples

- X QA/QC samples should be labeled similarly as the environmental samples.
- X Instructions for lab analyses of the QA/QC samples should be included on the chain-of-custody form.

## 6.0 REFERENCES

Commonwealth of Pennsylvania, Department of Environmental Protection, February 29, 1996. *Groundwater Monitoring Guidance Manual*.

Commonwealth of Pennsylvania, Bureau of Solid Waste Management, July 1985. *Guidance Manual for Ground Water Monitoring*.

New Jersey Department of Environmental Protection and Energy, May 1992. *Field Sampling Procedures Manual*.

Ohio Environmental Protection Agency, February 1995. *Technical Guidance Manual for Hydrogeologic Investigations and Ground Water Monitoring*.

U.S. EPA, November 1992. *RCRA Ground-Water Monitoring: Draft Technical Guidance*.

U.S. EPA, September 1986. *RCRA Groundwater Monitoring, Technical Enforcement Guidance Document*.

U.S. EPA, January 1991. *Compendium of ERT Groundwater Sampling Procedures*.

## # 116 - DEPTH TO GROUNDWATER AND NAPL MEASUREMENTS

### 1.0 SCOPE AND PURPOSE

This Standard Operating Procedure (SOP) describes procedures to be followed for determining groundwater level measurements as well as a description of the procedures to be followed for determining the depth to any non-aqueous phase liquid (NAPL) in monitoring wells, and the apparent thickness of the NAPL layers in monitoring wells.

Generally, water level measurements from boreholes, piezometers, or monitoring wells are used to construct potentiometric surface maps and product elevation maps. Product levels and thickness and water levels should generally be taken in a 24-hour period unless certain situations necessitate measurements be taken in shorter time intervals.

### 2.0 REQUIRED MATERIALS

The following list identifies the preferred types of materials to be used when measuring depth to water, depth to light NAPL (LNAPL), or depth to dense NAPL (DNAPL):

- X Electronic water level meter for water level measurements only (Solinst 101 or equivalent);
- X Interface probe (suitable for groundwater, LNAPL and DNAPL measurements);
- X Field Note Book and/or forms;
- X Decontamination solutions in dedicated squirt bottles; and,
- X Paper towels.

### 3.0 METHODOLOGY

#### Depth to Groundwater Measurements

- X Open the well and monitor the headspace with the appropriate monitoring instrument to determine the presence of volatile organic compounds if there is information to suggest that volatiles may be present at levels to warrant an upgrade in the level of PPE.
- X Locate the surveyed measuring point of the well. The surveyed measuring point location is typically the top of the inner well riser, and should be clearly marked in permanent ink on the well riser or identified in previous sample collection records. The measuring point location should be described in the Field Notes and should be the same point used for all subsequent measurements.
- X To obtain a water level measurement, lower a decontaminated water level meter (Solinst 101 or equivalent) into the monitoring well. Care must be taken to assure that the water level measuring device hangs freely in the monitoring well and is not

adhering to the wall of the casing. The water level measuring tape will be lowered into the well until the audible sound of the unit is detected or the light on an electronic sounder illuminates. At this time, the precise measurement should be determined (to hundredth of a foot) by repeatedly raising and lowering the tape to converge on the exact measurement. The water level measurement should be entered in the Field Notes.

- X The water level measuring device shall be decontaminated in accordance with SOP #115 immediately after use. Generally, only that portion of the measuring tape which penetrates the water table will require decontamination. If NAPL is encountered, use of a solvent (*e.g.*, hexane) will be required to clean the probe.

## NAPL Measurements

NAPL measurements should be made using an interface probe. Interface probes are commonly used to detect the presence of any floating (LNAPL) or sinking (DNAPL) immiscible layers. These probes can also be used to measure the water levels inside wells.

- X Using the grounding cable attached to the interface probe, ground the probe to a metal object (*i.e.*, protective steel locking well cover) to prevent electric shock.
- X The probe should be lowered slowly inside each well. When LNAPL is detected, the probe will make a solid tone. Record the measurement from the surveyed point on the top of the well casing to the top of the LNAPL. Continue lowering the probe (observing the calibrated drop line) until the steady tone stops. When water is detected, the probe will make a beeping noise to signify the beginning of the water column. When the beeping noise is heard, observe the calibrated drop line to determine the water level. Record this measurement. The measurement on the drop line between when the steady tone began (*i.e.*, LNAPL was encountered) and when it stopped (*i.e.*, groundwater was encountered) will determine the apparent thickness of the LNAPL layer.
- X The depth to DNAPL can also be determined using the interface probe. Lower the probe through the water column to the bottom of the well. The probe will make a solid tone if a DNAPL is encountered. Record the depth to the top of the DNAPL layer, and the depth to the bottom of the well to determine the apparent thickness of the DNAPL layer.
- X The NAPL measuring device should be thoroughly cleaned after each use in accordance with SOP #115. If NAPL is encountered, use of a solvent (*e.g.*, hexane) will be required to clean the probe.

## 4.0 QA/QC PROCEDURES

Quality control measures include repetitive measurements of the depth to water or NAPL to ensure that accurate and precise results are obtained. Once the measuring device indicates that the water level or NAPL layer has been encountered, the probe should be raised slightly and lowered several times to check and confirm the measurement. A single final reading should be recorded in the field notes or on the project specific form.

Water levels in piezometers and monitoring wells should be allowed to stabilize for a minimum of 24 hours after well construction and development, prior to measurement. Also, measurements should always be taken from the least to the most contaminated wells while decontaminating the equipment between each well.

If water level data are to be used for groundwater flow direction determination, all measurements should be taken within the shortest time frame feasible.

## 5.0 DATA RECORDING OR MANAGEMENT

Proper field data collection and management is important. Data may either be entered into a bound field notebook or other form specified in a site-specific work plan.

## 6.0 REFERENCES

United States Environmental Protection Agency, January 1991. *Compendium of ERT Groundwater Sampling Procedures*. EPA/540/P-91/007. Washington D.C.

United States Environmental Protection Agency, September 1986. *RCRA Groundwater Monitoring Technical Enforcement Guidance Document*. EPA/OSWER/9950.1. Washington D.C.

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## #119 - FIELD CLASSIFICATION OF SOIL SAMPLES

### SCOPE AND PURPOSE

This Standard Operating Procedure (SOP) presents sample identification scheme for soils. Standardization of the sample identifiers for all media will facilitate data tracking, review, and evaluation by all interested parties.

### APPLICABILITY

This scheme will be applied to all soils samples collected during site investigations. Minor modifications to the general scheme may be necessary for various sites or for use in computer data bases. Necessary modification to the following scheme should be addressed in the site sampling and analysis plan.

### PROCEDURE

A unique sample identification will be given to each soil sample collected. The identifier will be composed of three groups of alphabetical and numerical characters, which will identify:

- The project site;
- The sample location; and,
- The sample interval.

The three groups should be separated by dashes as in the following example:

AB-MW10-SS5

A precise method for sample identification, based on this generic scheme, should be presented in the site work and sampling and analysis plan.

Project Site (AB-): The first two digits of the sample identifier should be a two-character alphabetical code identifying the client and the site. For example, a project for the Acme Tent Company in Butler, Pennsylvania may be identified with the code "AB-." A unique project site identifier should be selected by the project manager and be specified the site work plan and the site sampling and analysis plan.

Sample Location  
(MW10-):

The second set of digits should be a combined alphabetical and numerical code that identifies the sample location and location type. The example identifies a soil sample collected during the construction of Monitoring Well 10. Commonly used sample location identifiers are listed below:

- SB - soil boring;
- SF - surface soil;
- TP - test pit; and,
- MW - monitoring well (if soil samples are collected from a boring completed as a well)

Sample Type and  
Interval (SS5):

The third group of characters should be both alphabetical and numerical characters that identify the sample interval. The example given identifies a soil sample collected from split-barrel sample 5. The boring log and field notes should reference the specific sampling interval (indicated numerically), but typically the number indicates the depth in feet below land surface where sampling began. Commonly used sample type identifiers are listed below:

- SS - split-barrel sample;
- ST - Shelby tube sample;
- CB - core barrel sample;
- CO - composite sample; and,
- AC - auger cuttings.

Samples collected for replicates or duplicates will be identified with the characters "REP" and a numerical designation in the second group. A sample type and interval code should be used for the third group (e.g., AB-REP02-SS5). The replicate source indicated by the number in the second group should be defined in the field notes. If trip or field blanks are required (these are typically deionized water samples or rinsate samples collected from soil sampling tools), the sample identification scheme will include TB or FB and a number in the second group. The number should identify the source of the blank and be described in the field notes. A sample type and interval code for blank samples is not required.

All sample numbers should be clearly identified with the sample description in the field notebook and should be used on the chain-of-custody and analytical request forms.



## #121 - UTILITIES

### 1.0 SCOPE AND PURPOSE

This Standard Operating Procedure (SOP) presents procedures for locating utilities, particularly underground utilities, prior to conducting intrusive field work. Information regarding the location of underground and overhead utilities may be obtained from the client or site owner in some instances. This, however, does not eliminate the need by Key Environmental, Inc. (KEY) to assure that utilities have been fully identified and to avoid those areas (where possible) where it is difficult or impossible to adequately locate underground utilities. If available information does not conclusively determine the presence/absence of utilities in a particular area, alternative measures (*i.e.*, metal detectors, magnetometers or hand excavation) may be employed.

Damage to gas and electric lines could result in loss of life or serious personal injuries. Damage to utilities may also result in loss of service to factories and home owners and potentially result in lawsuits filed by affected parties. The purpose of this section is to provide a procedure for KEY employees to follow in order to identify, locate, and avoid utility lines. This procedure does not, however, cover every possibility in terms of identifying utilities. The field crew must always be alert to the possibility of buried or overhead utilities whether known to be present in the area or not. Thus, a visual inspection of the area must be conducted to identify any indication of the possible presence of utilities (*i.e.*, fire hydrants, meters, repaired pavement, disturbed soils, markers, *etc.*)

The location and identification of utilities is applicable to all sites, particularly when subsurface exploration is carried out.

#### Definitions

**One-Call System:** A communication system established by utilities, governmental agencies, or other operators of underground utilities to provide a single telephone access number for excavating contractors and the general public to notify utilities of their intent to use equipment for excavating, tunneling, demolition, or any other similar work that could affect underground utilities. This system may go by other names (*e.g.*, "Miss Dig," "Miss Utility," or "Dig Safe").

### 2.0 METHODOLOGIES

No subsurface work should be performed until the presence or absence of all possible utilities has been verified. In some cases, it will not be possible to map the exact location of all known utilities on the site, but it should be possible to define those general areas where utilities are known to be present and those areas believed to be free of underground utilities.

If KEY is required to locate buried utilities, the utility representatives should be called and an on-site meeting will be required. At no time should KEY employees use equipment to locate utilities on their own. Often the most convenient initial step in locating buried utilities in an area

is to contact the appropriate one-call telephone number. The one-call markings are only considered good for two weeks. For projects of longer durations, the one-call contact may need to be repeated periodically. After making the one-call, a reference or I.D. number will need to be recorded in the field notes.

All communications with utility companies should be documented in writing. When meeting in the field, include in the field notes and/or forms the name of the utility representative, the date and time of the meeting, a summary of the discussions, and a sketch of where utilities are located. A map of the utility locations should be made in the field notes since the physical marks (paint or flags) left by the utility representative may not survive to the completion of the investigation. Many times the utility will have area maps that show the location of their lines. Copies of these maps, if available, could be filed with the project notes. Ask the utilities' representatives to sign the summary in the field notes (they may not be willing to do this).

The KEY representative should ensure that the utility representative physically marks the utility locations. They should be identified for the entire area or as much as is feasible since it is difficult or impossible to know at the beginning of a study how extensive the investigation may be. It may also be important to know where utility lines may cross potential contaminant source area(s) as utility trenches may provide migration pathways. If discrepancies exist between utility locator's information and obvious signs of buried utilities or other location information (e.g., utility maps), then work should not proceed at that location until the discrepancies have been resolved.

The KEY field supervisor should coordinate with the project manager and facility personnel to compile a list of all possible underground utilities. The following list of possible underground utilities should be used as a reference list; it is not, however, inclusive of all possible buried utilities:

<b>Public Utilities</b>	<b>How to Locate <sup>(1)</sup></b>
Natural gas and petroleum pipelines	1
Water mains	1
Natural gas	1 and 2
Electrical power	1 and 2
Telephone	1 and 2
Cable television	1 and 2
Sanitary sewers	3
Storm sewers	3
Traffic control signals	4
 <b>Private or Facility Utilities</b>	
Natural gas	5, 6, 7, and 8
Electrical power	5, 6, 7, and 8
Telephone	5, 6, 7, and 8
Sanitary sewer	5, 6, 7, and 8

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Process waste tanks and effluent pipes (National Pollutant Discharge Elimination System discharges)	5, 6, 7, and 8
Septic system drain fields	5, 6, 7, and 8
Storm sewers and rain gutters	5, 6, 7, and 8
Liquid feed stock tanks and distribution lines	5, 6, 7, and 8
Liquid fuel tanks and distribution lines	5, 6, 7, and 8
Cooling water	5, 6, 7, and 8

1. Call the pipeline or utility company for location information.
2. Call one-call or similar service.
3. Check utility maps at the city engineer's office (request field verification).
4. Check maps or other guidance with the city traffic engineer.
5. Use professional locator service.
6. Check with facility engineering department.
7. Identify where utility enters and exits property with the public utility.
8. Check with private contractors that have or are currently working for the facility.

The above methods of locating utilities should not be substituted for field observation and good judgment. Prior to initiating an excavation or boring, an inspection of the excavation/drilling zone may provide additional indications about the location of nearby underground utilities. Depressions or mounds on the ground surface, new paving patches, manholes, meters, valves, fill lines, vents, power line drops from power poles, sewer clean cuts, catch basins, outfalls, utility connections into nearby structures, areas with linear patches of cleared vegetation, and old utility markup points, such as spray painted lines on curbs and roadways, all may be indications of the presence of utilities. If questions remain regarding the presence of utilities in a work area, contracting a company that specializes in underground utility locating should be considered.

### 3.0 DATA RECORDING AND MANAGEMENT

An accurate record of all people and organizations contacted during a site utilities search should be recorded in a field note book and/or the forms attached to this SOP. A brief summary of any phone, or face to face conversations, should be recorded. Utilities identified should be sketched or mapped. Field observations (indications) that infer the presence of utilities should be described in the field book.

## #122 - MANAGEMENT OF INVESTIGATION DERIVED WASTES

### PURPOSE

This standard operating procedure (SOP) presents general guidelines for the management of investigation derived wastes (IDWs), such as, but not limited to the following:

- X Drill cuttings generated during soil boring investigations or well installations;
- X Drilling fluids generated during soil boring investigations or well installations;
- X Groundwater generated during well development, monitoring well purging, aquifer testing (i.e., pumping tests), or remedial activities;
- X Water and sediment generated during equipment decontamination;
- X Used personal protective equipment; and,
- X Miscellaneous debris (e.g., well construction materials generated through abandonment of monitoring wells).

Due to the wide range of materials which may be generated and the variety of situations which may arise, it is likely that these SOPs will need to be supplemented with project-specific procedures. Where project-specific procedures are necessary, they should be developed to be consistent with the general guidelines presented below. Determination of the need for and scope of the development of project-specific procedures, will be determined as part of the initial project planning.

### CONTAINERIZATION

Project-specific requirements for containerization of waste materials will be developed during initial project planning. If applicable, this information may be presented in a project-specific waste management plan. Project-specific containerization requirements should be developed to be consistent with the general guidelines provided below.

1. All potentially impacted materials generated during any investigation or remedial activity must be containerized unless one of the exceptions described below under Item 10 apply. Unless directed otherwise by the client, containers (drums, frac tanks, roll-off boxes, etc.) are to be provided by the consultant or contractor.
2. All potentially impacted materials shall be placed in new or reconditioned 55-gallon (DOT-UN1A2) drums. All drums brought onsite must be clean and in sound condition, free of any rust, dents, holes, or other types of damage.
3. Various types of waste materials (e.g., soils, groundwater, PPE, etc.) must be containerized separately without exception. Additionally, dry and wet soils should be containerized separately, if feasible.
4. Materials generated from various plant process areas, which may require potentially different waste classifications, should be containerized separately. As an example, soils

generated in the vicinity of a surface impoundment which managed sludge from the treatment of wastewater from wood treating operations that use creosote and/or pentachlorophenol (EPA Hazardous Waste K001) should be containerized separately from soils generated in a creosote drip track area (EPA Hazardous Waste F034). Likewise, materials generated at off-site locations should be managed separately from those generated on-site.

5. If possible, drums should be filled to approximately 90% capacity. As necessary, drums containing liquids should have enough freeboard to prevent rupture in the event of freezing.
6. Containers inside of containers are not permitted by waste management regulations. As a result, PPE must be placed directly into the drum. **Do not place PPE in a plastic bag and in turn place the plastic bag into a drum.** This constitutes a violation of waste management regulations. Similarly, all soil samples must be removed from jars or plastic bags and the jars crushed or plastic bags torn prior to being placed in a drum.
7. All lids and gaskets must be securely fastened prior to moving from one location to another. The consultant or subcontractor is responsible for transporting containers to an on-site temporary staging area as directed by the Facility Waste Management Director. Containers must be loaded, transported and unloaded in a safe manner.
8. The exterior of all containers must be thoroughly cleaned prior to staging. All mud, dirt or debris must be removed, with no exception. Waste management facilities will not accept containers which are visibly dirty on the outside.
9. Under no circumstances shall non-waste materials or general trash be placed in waste containers. The consultant/subcontractor should provide a dumpster for management of non-waste materials and general trash.
10. Under certain circumstances, the following exceptions to the above requirements may be made if provided by regulations and state/federal concurrence:
  - a. Some regulatory agencies may allow for all or a portion of generated materials (i.e., auger cuttings, drilling fluids) to be placed back into or onto the ground from which they were generated. The consultant is responsible for identifying these requirements.
  - b. If an operating water treatment facility exists on-site, groundwater and/or decontamination liquids may be managed into the treatment system if the discharge permit for the treatment facility provides for management of those liquids, and the liquids do not contain materials (e.g., solids or oils) which could potentially effect the operation of the system in an adverse manner. In this instance, consideration must be given to the classification and management of waste materials generated through the treatment of the liquid (e.g., spent activated carbon, filtered soils, etc.)

## CONTAINER DESIGNATION AND LABELING

Project-specific requirements for container identification and labeling will be developed during initial project planning. If applicable, this information may be presented in a project-specific waste management plan. Project-specific container designation and labeling requirements should be developed to be consistent with the general guidelines provided below.

1. Each container will be assigned a unique designation. This designation should include a sequential number associated with each waste type, a code which identifies the type of waste (e.g., "S" for soil, "GW" for groundwater, etc.), and the date the material was placed in the container (e.g. 1-GW-12/12/98; 2-GW-12/12/98 etc...). The container designation must be clearly marked on the lid and the side of the container prior to transport to the temporary on-site staging area. The markings must be made in a manner such that the markings are legible, highly visible and permanent (i.e., weather resistant). A "Mean Streak®" grease pen or a paint stick is recommended for marking the container.
2. A "Non-Hazardous Waste" label shall initially be affixed to the exterior side of the drum at a location at least two-thirds of the way up from the bottom of the container. Under the optional information section on the label, the following statement may be included "Material Classification Pending Results of Analysis".
3. The following information is to be recorded by field personnel in the field notebook, as appropriate.
  - a. Container Designation;
  - b. Contents (e.g., soil, groundwater, PPE);
  - c. Date that the container was filled;
  - d. Location where the drums are staged;
  - e. Location, and plant process area, where the material was generated (e.g., soil boring number, monitoring well designation);
  - f. Relative moisture content (e.g., dry, moist, damp, wet, saturated) for soils only, for the purpose of managing the materials for disposal, damp or moist soil are considered "liquid"; and ,
  - g. Approximate volume or percentage of the container filled.

## CONTAINER STORAGE

Project-specific container storage requirements will be developed during the initial planning phase. If applicable, this information may be presented in a project-specific waste management plan. Project-specific container storage requirements should be developed to be consistent with the general guidelines provided below.

1. If the investigative or remedial work is conducted at active or inactive sites owned formerly by the consultant's client, plans for container storage must be developed in conjunction with the current property owner.

2. If containers are to be transported to an on-site staging area, all container handling and moving must be conducted in a safe manner. Contractors are responsible for providing the necessary equipment (e.g., front-end loader, fork lift with drum grapppler, etc.) to provide for safe and efficient staging of containers.
3. All containers shall be stored in a neat and organized fashion with all labels clearly visible. Containers shall not be stacked.
4. Containers holding materials of different waste classifications should be staged together to facilitate loading of the materials onto transport vehicles.
5. To the extent practicable, all containers should be protected from the elements.
6. If stored outdoors in an area where precipitation could accumulate, all containers must be placed on pallets.
7. In accordance with DOT requirements, all containers must be rust-free and in sound condition for shipment.
8. Prior to demobilization, field personnel should conduct an inspection of the container storage area to ensure all containers are clearly marked, clean and staged in a neat and organized manner.

## WASTE MATERIAL INVENTORY

KEY personnel are responsible for completing an inventory of waste materials stored at the project site. The inventory should be completed and entered into the central computer file at KEY's main headquarters in Carnegie, Pennsylvania as soon as possible following field demobilization. The central file is located on the data server by site name in the general directory - Dataserver-P:\aaprojects\IDW\Year\Sitename.exe. The inventory will include a tabular summary of all containers stored at the project site and their respective contents. An example is provided as Attachment "A". Information should be entered into a tabular summary located by site name in the central file under the following headings:

- a. **Related Activity of Waste Generation** (e.g., RFI, Pilot Study, Interim Measures, etc.);
- b. **Type of Container** (e.g., drum, roll-of box etc.);
- c. **Container Designation** (the unique label affixed to the drum);
- d. **Container Contents** (e.g., soil, groundwater, PPE);
- e. **Generation Date** (date that the container was filled);
- f. **Staged Location** (location where the drums are staged pending removal);
- g. **Location and Plant Process Area Where Waste Was Generated** (e.g., former Process Area, Former Drip Track Area, etc.);

- h. **Relative Moisture Content** (e.g., dry, moist, damp, wet, saturated) for soils only, for the purposes of managing these materials, damp or moist soils are considered wet;
- i. **Volume or Percentage Contained (gallons)**; (volume or percentage of drum filled - not to exceed 90 percent);
- j. **Comments** (other pertinent information, as appropriate); and
- k. **Date Removed** (the date the drums are removed from the site for disposal).

## WASTE MATERIAL SAMPLING AND ANALYSIS

Composite samples of the containerized materials for laboratory analysis may be collected for each IDW media. The results of the analysis may be used for waste profiling purposes required by the waste management facility and/or waste classification purposes. Project-specific requirements for waste sampling and analysis will be developed during initial project planning. If applicable, this information may be presented in a project-specific waste management plan. Project-specific waste material sampling and analysis requirements should be developed to be consistent with the standard procedures provided below. To the extent practicable, historical information, site-specific analytical data and knowledge of the waste composition should be utilized to minimize sampling and analysis requirements.

1. Specific details regarding the number and types of samples to be collected, required laboratory turn-around time, analytical parameters and analytical methods will be determined on a project-specific basis during the initial planning phase. If applicable, this information may be presented in a project-specific waste management plan.
2. At a minimum, samples must be collected and handled in accordance with standard industry protocols. If an approved project-specific Sampling and Analysis Plan or Quality Assurance Project Plan exists, then sample collection and handling procedures, as specified therein, must be followed.
3. All analyses must be performed using the appropriate analytical methods specified in EPA SW846 "Test Methods for the Evaluation of Solid Wastes".
4. The sampler must complete and maintain copies of all chain-of-custody documentation.
5. In accordance with Subpart CC or 40CFR Part 264/265 which became effective on December 6, 1996, hazardous wastes containing greater than 500 parts per million by weight total volatile organic compounds (VOCs), are subject to the emission control requirements of this rule. Determination of VOC content may be made through laboratory analyses or generator knowledge. Thus, analysis for VOCs will likely be required by the waste disposal facility for profiling purposes in the future. Analysis is to be performed using method 25D in 40CFR Part 60 Appendix A, or through the use of an approved alternate method. Knowledge-based waste determinations must be thoroughly documented.



6. Composite samples of similar waste classification of containerized materials will be profiled based on the characteristics presented in 40 CFR Part 261 Subpart C - Characteristics of Hazardous Wastes:
- §261.21 - Characteristic of Ignitability.
  - §261.22 - Characteristic of Corrosivity.
  - §261.23 - Characteristic of Reactivity.
  - §261.24 - Toxicity Characteristic.

## **TRANSPORTATION AND DISPOSAL**

Transportation, disposal, and manifesting of IDW are the responsibility of the owner.

**ATTACHMENT A**

**EXAMPLE WASTE INVENTORY SUMMARY**

## #123 – MONITORING WELL CONSTRUCTION IN UNCONSOLIDATED FORMATIONS

### 1.0 SCOPE AND PURPOSE

The purpose of this SOP is to provide procedures for the proper construction of groundwater monitoring wells in unconsolidated formations. Groundwater extraction, or pumping test wells, will be constructed following the same general procedures, but will be designed incorporating site and project-specific parameters.

Monitoring wells are used for many purposes: collection of groundwater samples for chemical analysis; measurement of groundwater levels; detection of free-phase constituents; and conducting aquifer tests. The specific purpose for which the well is constructed, the regulatory framework within which the well is constructed, the expected useful life of the well, and other factors may have significant bearing on the construction technique employed. However, all wells, regardless of the intended purpose, should be constructed to minimum standards to assure the following:

- Good hydraulic connection is established between the well and the aquifer of interest;
- Water from separate aquifers is not allowed to mix (*i.e.*, cross-contamination is prevented);
- Well construction activities do not alter the chemical characteristics of the aquifer;
- The well is properly sealed to prevent entry of surface water; and
- The well is properly identified.

The discussion that follows should provide the minimum standards necessary to provide these assurances. Figure 1 is a schematic diagram of a typical monitoring well showing the proper placement of all the components discussed below. The following published documents should be consulted for further guidance on specific construction practices:

- "Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells," (Aller *et al.*, 1989);
- "Groundwater and Wells," (Driscoll, 1986); and
- "RCRA Ground-Water Monitoring Technical Enforcement Guidance Document," (U.S. Environmental Protection Agency, 1986).

The following definitions are necessary for the use of this SOP:

**Bentonite:** A hydrous aluminum silicate comprised principally of the clay mineral sodium montmorillonite. Bentonite possesses the ability to expand significantly when hydrated; the expansion is caused by the incorporation of water molecules into the clay lattice. Hydrated bentonite in water typically expands 10 to 15 times the volume of dry bentonite. Bentonite forms an extremely dense clay mass with an in-place permeability typically in the range of  $1 \times 10^{-7}$  to  $1 \times 10^{-9}$  centimeter per second when hydrated.

**Bentonite**

**Grout:** A slurry generally prepared by mixing dry bentonite powder into fresh water in a ratio of approximately 15 pounds of bentonite to 7 gallons of water to yield 1 cubic foot (ft<sup>3</sup>) of bentonite slurry. The bentonite and water are mixed by moderate agitation, either manually in a large tank or with a paddle mixer. The use of high-shear mixing equipment increases the viscosity development of the slurry and can reduce the ultimate working time by as much as 20 percent. Thick bentonite slurries may swell quickly into nonpumpable gel masses that cannot be emplaced. Premix and/or polymer (organic and inorganic) additives delay the wetting of the bentonite and prevent premature hydration. Where additives are used, the additives should be evaluated for potential effects on groundwater quality. Once the slurry is mixed, it should remain workable for between ½ to 2 hours. During this time, a positive displacement mud or grout pump (typically a centrifugal, diaphragm, piston, or moyno-type pump) is used to emplace the grout at the desired depth.

**Cement/Bentonite**

**Grout:** A slurry generally prepared by mixing Portland cement (Type I, American Society for Testing and Materials C 150) and bentonite powder into fresh water in a ratio of 1 bag of cement (94 pounds or 1 ft<sup>3</sup>) to 2 to 5 pounds of bentonite to 5 to 6 gallons of clean water. The bentonite improves the workability of the slurry, reduces the slurry weight and density, and reduces shrinkage as the slurry sets. Bentonite also reduces the set strength of the grout, but this is rarely a problem because the grout is seldom subject to high stress.

**Grout:** A slurry of high water content fluid enough to be poured or injected as a slurry into fissures, joints, permeable rocks, or subsurface voids, such as a borehole, in order to reduce their permeability.

## 2.0 REQUIRED MATERIALS

Materials used for drilling and constructing monitoring wells in unconsolidated formations will vary according to the chosen drilling and subsurface sampling methods, and well design. Based upon the chosen methods, the subcontracted drilling firm will be responsible for providing a drilling rig, support equipment, and trained drilling crew capable of performing the requested

drilling and installation activities. Any qualified drilling subcontractor will typically know, based on experience, what equipment will be required for specific situations. It is necessary, therefore, to provide the driller with as much information as possible regarding the requirements and objectives of the drilling and well installation program, as well as the subsurface conditions expected to be encountered.

Besides the general equipment necessary to drill the boring, well installation equipment will likely include the following:

- Various pumps (mud, trash, grout, *etc.*);
- Various hoses for fluids and air;
- Casing lifts (cables, clamps, hoists);
- Portable water tank, transfer lines, and pump (if necessary);
- Cutting torch and welder;
- Grout and slurry mixing machines; and
- Tremie lines and drop pipes.
- The drilling subcontractor will also obtain the required materials for the well installations. Material specifications will be the responsibility of the overseeing geologist, engineer, and/or hydrogeologist. The specifications are dependent upon subsurface conditions expected to be encountered. The process by which the proper materials are selected is presented in section 3.0 of this SOP.

Well construction materials typically include the following:

- Temporary casing;
- Well screen;
- Riser pipe (to extend from the screen to the surface);
- Centralizers;
- Sand and or gravel pack;
- Sealing materials (bentonite pellets, powders, *etc.*);
- Grouting materials (Portland cement and appropriate additives);
- Protective steel casings, manholes, and/or flush-mount caps;
- Compression caps;
- Locks; and
- Concrete for construction of a sloping pad.

In addition to the equipment and material needs of the drilling subcontractor, the geologist, engineer, and/or hydrogeologist overseeing the monitoring well construction activities will require particular items to assist in documenting construction activities. Equipment and materials likely to be used by oversight personnel may include:

- Field notebook;
- Camera and film;
- Mud balance (for measuring grout densities);
- Weighted tape for measuring borehole depths, and well construction material placement;
- Tape measure and/or ruler;
- Water-level and/or interface probe; and
- pH, temperature, specific conductivity, and turbidity meters (for well development documentation).

### **3.0 METHODOLOGIES**

#### **3.1 Borehole Construction**

Drilling methods and borehole construction practices are discussed in SOP No. #110. When a boring may be used for construction of a monitoring well, the driller should use a high-pressure, hot water, power washer (steam cleaner) to clean all bits, pipe augers, and any other drilling or sampling tools that may be used in the advance of the borehole (SOP's #104 and 115). No grease or other machine lubricants should be used during the well construction (some regulatory agencies will allow selected lubricants with prior approval). The borehole must be of suitable diameter (the diameter of the boring should be at least four inches greater than the outside diameter of the well pipe) and depth for the monitoring well planned. If the boring extends more than a few feet below the planned depth of the monitoring well, the lower portion of the boring should be sealed with a structurally suitable grout to provide a base for the well. The grout should be hydrated and placed as a slurry under pressure through a tremie pipe. Cement grouts should not be used to seal borings because of possible effects on groundwater chemistry.

#### **3.2 Well Casing and Screens**

The well casing (riser pipe) and screen for most monitoring well installations will be two- or four-inches in diameter. Two-inch diameter wells are generally used because:

- They require smaller borehole diameters, which reduce drilling costs;

- The smaller diameter reduces the volume of cuttings, which may have to be disposed;
- Construction material costs are lower; and
- The volume of water that must be purged during well sampling is less.

A four-inch diameter well may be preferred when wells are built to collect groundwater samples from silt and/or clay sediments. Wells screened in these sediments tend to produce turbid samples. Increasing the well screen diameter reduces the groundwater entrance velocity, which helps to reduce the turbidity of the samples. Using "wire wrapped" as opposed to slotted screens will also help to reduce sample turbidity for the same reason. Increasing the well diameter also reduces the surge energy that reaches the formation when a snug fitting bailer is dropped into the well to collect samples. The selection of well diameter for low yielding silt and/or clay aquifers should take into account the volume of water to be purged from the well during sampling. Costs associated with disposal of purge water and slow labor requirements for purging/sampling wells recharge wells may negate the advantage of installing a larger diameter well. A four-inch diameter well may also be preferred when wells are built to collect groundwater samples from sand and/or gravel material. Wells screened in highly transmissive aquifers are occasionally difficult to fully develop without pumping. For this reason, well diameters may be increased to accommodate a submersible pump. Deeper wells may also require a submersible pump to efficiently lift groundwater during development and purging.

For most groundwater monitoring applications, polyvinyl chloride (PVC) is a suitable material for both well casing and screens. It is readily available, is low in cost, and generally unaffected by the chemistry of most groundwaters. However, when sampling for chlorinated organic compounds, PVC pipe and screens may be unacceptable. Also, some phase-separate liquids, including some petroleum products or high concentrations of some solvents, may have an adverse effect on the integrity of PVC pipe and screens. The material supplier can usually provide information regarding material incompatibilities if the nature and concentration of the contaminants are known. Some regulatory agencies require specific well construction materials for monitoring well use. Wells intended for the collection of monitoring data subject to regulatory review must be constructed of materials and in a manner approved by the designated agency.

Stainless steel pipe and screens are usually an acceptable alternative when PVC cannot be used. Stainless steel is more expensive than PVC and will usually require one or two weeks lead time to assure delivery of materials.

In some cases, where metals are a contaminant of concern, stainless steel is unacceptable and PVC or other well screen and casing materials (e.g., Teflon™) should be used. Combinations of materials may also be used in some cases (for example, using stainless steel or Teflon™ for those portions of the well below the water table and PVC through the unsaturated zone). Attention must be given to the joints of these hybrid wells. To eliminate corrosion where dissimilar construction materials connect (for example, if a well is constructed of stainless and

black steel pipe) nonconductive joint rings may be necessary at the fittings. The material supplier can usually provide information regarding material incompatibilities. Terminating the well with a section of PVC pipe may also make the well completion easier to accomplish, especially where the top of the well pipe must be cut to fit inside a surface-mounted well cover.

Threaded well casing and screens are generally available for most monitoring well applications and are preferred over other joint types. The threaded joints typically include an O-ring that, when properly installed, assures a leak-tight joint. Threaded joints also reduce the chance of introducing organic constituents to the well, which may occur when solvents are used to weld PVC pipe. The threaded joints also provide a smooth interior, which reduces the likelihood that sampling tools or measuring tapes will become hung up inside the well. Teflon<sup>TM</sup> tape may be used to lubricate threads, and clean water or hydrated bentonite may be used to lubricate O-rings.

The well casing and screens should always be new material. Proper storage, both at the site and before delivery, is required to assure the pipe is clean.

A threaded, slip-over or an expanding-type well cap should top each well. The well cap should have a small hole drilled through it to maintain atmospheric pressure at all times. This allows wells to recover more quickly to static conditions after sampling and will help prevent the cap from sticking due to a low-pressure condition in the well. A threaded plug should be installed in the bottom of the well. A small hole should be drilled through the plug to allow the well to completely drain should the water table drop below the bottom of the well, if applicable.

Centralizers should be used depending upon the depth of the well to assure the well casing is centered in the borehole unless the well is installed through hollow stem augers. Hollow stem augers will keep the well reasonably centered without the use of centralizers. One centralizer should be placed at the bottom of the well screen and another approximately 10 feet below the top of the well. Additional centralizers should be placed at 25-foot intervals.

Well screen slot size should be selected based on the grain size of the formation to be sampled. The well screen should retain 90 percent of the formation sand for naturally developed wells or 90 percent of the filter pack sand. If a grain size distribution is not available for the formation, the following guideline (Gass, 1988) should be followed.

<i>Anticipated Strata</i>	<i>Well Screen Size</i>	<i>Filter Pack Material (Approximate Range of Standard United States Sieve Sizes)</i>
Sand and gravel	0.030	20 to 4
Silt and sand	0.020	30 to 8
Clay and silt	.010	50 to 16



### **3.3 Annulus Filling**

Naturally developing a monitoring well (allowing the natural formation sands to cave around the well screen) is acceptable when the grain size distribution of the formation is known and the well screen was properly selected to retain the formation sand. However, this information is not usually available before the well is constructed. Consequently, most monitoring wells will be filter packed.

Filter pack sand should be clean, well-rounded, uniformly sized (uniformity coefficient of 3.0 or less) silica sand, free of organic matter and carbonate grains. The filter pack should be placed from the bottom of the well to no less than 1 foot nor more than 2 feet above the well screen. The filter pack should not be allowed to free fall through the water column, as this may cause the sand to segregate by grain size. The filter pack sand should be washed into place through a tremie pipe with water from a potable source. A 0.5-foot thick layer of very fine sand (sand blotter) should be placed at the top of the filter pack to separate the filter pack from the overlying bentonite seal.

A bentonite seal should be placed in the well above the filter pack sand. Bentonite pellets or natural chunks may be used if they are installed below the water table and do not have to free fall through more than approximately 15 feet of water. Where the bentonite is installed through more than 15 feet of water, the bentonite should be hydrated and placed as a slurry under pressure through a tremie pipe. The slurry should consist of approximately 15 pounds of powdered bentonite to 7 gallons of portable water. The tremie pipe should have a deflector at the bottom to prevent the grout from being jetted into the filter pack sand.

The bentonite seal should extend from the top of the sand blotter up the annular space to the water table surface for a minimum of 3 feet. A second 0.5-foot thick sand blotter should top the bentonite seal. The annular space above the water table should be filled to within 5 feet of the surface with a cement/bentonite grout consisting of 2 to 5 pounds of powdered bentonite per bag of Portland cement mixed with 5 to 6 gallons of potable water (SOP #111). The cement/bentonite grout should be tremied into place from the bottom of the annulus to the top. The tremie pipe should have a deflector at the bottom to prevent jetting of the grout into the bentonite seal.

Cement/bentonite grout should be used as the annulus seal directly above the filter pack or the sand blotter when the well screen extends above the water table. Within the unsaturated zone, the formation may not yield sufficient water to keep a bentonite seal fully hydrated. If a bentonite seal dries out, it may crack, jeopardizing the integrity of the seal.

Where the concentration of total dissolved solids in the groundwater is high (greater than approximately 500 parts per million), the chloride concentration is high, or when substantial thickness of phase-separated liquids are present, neither bentonite nor cement/bentonite grouts may be suitable. Under these cases, the grouting material must be selected based on the specific characteristics present at the site.

The upper five feet of the annulus (or to the top of the bentonite seal when it terminates at depth less than five feet) should be filled with concrete. This portion of the annulus seal needs the structural strength of concrete to protect the casing and the well cover. The concrete should extend below the frost depth. The concrete should be no more than a few inches larger in diameter than the well borehole. This will prevent frost action from lifting the well. The top of the concrete should slope away from the well to direct rain water away. Where a concrete apron surrounding the well is desired or required by regulation, it should be constructed with a joint around the concrete that fills the top of the annulus to assure separation of the well from the apron.

### **3.4 Well Covers and Surface Finishing**

A well cover should be set in the concrete at least three feet below the ground surface and extend one to two inches above the well pipe. The diameter of the well cover should be sufficient to allow room to remove the well cap with gloved hands. The well cover should have a locking, hinged lid that prevents the entrance of rain water. A small hole should be drilled in the side of the well cover approximately six inches above the ground surface to allow moisture to drain from the well cover. The space between the well cover and the well pipe should be filled with coarse sand or fine gravel.

Alternately, the well may terminate in a specifically built surface mount well cover. The surface mount well cover should never be used when the ground surface is low and storm water could pond over the well. When the existing surface is low and a flush mounted well is designed, the surface should be regraded to prevent water from standing over the well. In paved parking lots or driveways, a small mound two to three inches high sloping away from the well may be sufficient to divert storm runoff away from the well opening.

Permanent labels should be affixed on both the inside and outside of the well cover lid. The label should include a unique well identification code and the elevation of the water level measuring point. The label may also include the date the well was drilled. A notch should be cut or filed in the top of the well pipe to mark the water level measuring point.

## **4.0 QA/QC PROCEDURES**

Field Quality Assurance/Quality Control (QA/QC) procedures can be implemented to ensure that a monitoring well has been installed according to the designed specifications.

Field QA/QC begins with an inspection of the well construction materials. The materials should conform to those specified in the design, or to generally approved and accepted materials. Damaged materials, as well as opened or visibly contaminated materials (sandpack, well screens and risers) should not be used. Small samples of well backfill materials (sandpack, gravel pack, and bentonite) should be collected. Should the well malfunction or fail at a later date, these samples may assist in identifying the source or cause of the malfunction or failure.

Placement of monitoring well construction materials should be monitored closely to ensure placement of backfilled materials to the appropriate depths. All materials should be placed slowly into the borehole to prevent backfilling to a level beyond the designed level. A weighted tape, or a known length of lightweight rigid PVC, can be used to measure the depth below ground surface to the top of the well construction materials placed within the borehole.

Although lengths of screen and riser pipe are manufactured to close tolerances, variations in length typically occur. Therefore, good practice necessitates that the total length of the well be measured once it is assembled and placed in the borehole. The length can be measured by dropping a weighted tape into the bottom of the well. Based on the measured total well depth and the relative stick-up above ground surface, the depth of the well can be adjusted to obtain the proper depth below ground surface.

Close monitoring of grouting should be performed to ensure that grout of an appropriate consistency is administered to the borehole. The density of the grout can be measured with a mud balance scale and compared to design specifications. The grout should be measured on a per batch basis. As grout is pumped into the borehole to seal the well from the surface, grout flowing from the borehole should be of the same consistency as that being pumped into the borehole. Grout should be pumped into the borehole until the observed consistencies are the same, thereby indicating that diluted grout has been displaced from the borehole.

Occasionally, cutting of the well riser is necessary to accommodate surface finishing. Should the riser require cutting, all efforts should be made to prevent shavings, grindings, etc, from entering the well. A temporary expandable plug should be placed within the riser at a safe distance below the cut line. The plug and shavings can be removed after cutting.

Throughout the construction process, the well should be checked for obstructions due to flexing and kinking of the well, or collapse of weak construction materials. A rigid "dummy" block, constructed of an appropriate material, can be lowered into the well to check for clearances and obstructions. The diameter and length of the dummy should be similar to that of equipment to be installed in the well (pumps, controls, data loggers, etc.).

If the plumbness and alignment of the well is critical for its intended use, the well should be tested in accordance with AWWA Standard A-100-84. Test methods and allowable tolerances should be provided in the drilling specifications.

## 5.0 DATA RECORDING

Information to be collected during monitoring well installation will include, at a minimum, the following information:

- Well construction material type (stainless steel, PVC, etc.);
- Diameter of well materials;
- Diameter and depths of boreholes;

- Casing diameter, depth, and material;
- Drilling methods;;
- Type, quantity, and depths of borehole sealing materials (above and below the well);
- Type, quantity, and depths of screen packing (gravel and/or sand);
- Grout volumes and densities;
- Total depth of well (ft bgs);
- Depths of screen materials (ft bgs);
- Protective casing stick-up (ft above ground surface);
- Riser stick-up (ft above ground surface, or below if flush-mount system);
- Static depth to water (ft below an identified reference mark); and
- Methods of material placement.

Recording of the data should be completed in the field at the time of measurement or observation. The field book should be the primary repository for field data and observations; however, field forms may provide a more suitable format for collecting and analyzing the data.

In addition to the well construction specifics identified above, the following information should be recorded to provide a clear account of the well construction project:

- Drill rig make/model, name of drilling subcontractor, and driller's name(s)
- Weather conditions;
- Boring location identification, including physical description of location in reference to site features, and description of surface conditions at location;
- Borehole advancement method;
- Depth to water at completion of boring; and
- Any problems or significant events that occurred during drilling and sampling.

## 6.0 REFERENCES

Gass, Tyler E., 1988, Monitoring Well Filter Pack and Screen Slot Selection: A Reassessment of Design Parameters, Water Well Journal, Vol. 42., No. 5., pp. 30-32.

U.S. Environmental Protection Agency, 1986, RCRA Ground-Water Monitoring Technical Enforcement Guidance Document, Office of Solid Waste and Emergency Response, Washington, D.C.

Aller, L., T.W. Bennett, G. Hacket, R.J. Petty, J.H. Lehr, H. Sedoris, D.M. Nielsen, 1989, Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells, National Water Well Association, Dublin, Ohio.

Driscoll, F.G., 1986, Groundwater and Wells. Second Edition, Johnson Division, St. Paul, Minnesota.

## SOP 124 – SURFACE WATER SAMPLING

### 1.0 SCOPE

Surface water sampling defines the process of collecting water samples from a water body (e.g. stream, river, lake, pond, etc.). Surface water samples are usually collected from various sections of a length of a flowing body of water (e.g. stream or river), and from various depth intervals of standing, non-flowing bodies of water (e.g. lake). For flowing bodies of water, samples are typically collected from a point down-gradient, adjacent to, and up-gradient of the investigation area. This sampling procedure enables a determination of potential contributions of constituents of interest from the investigation area (by groundwater discharge or overland flow) to the surface water feature. For non-flowing water bodies, stratification of waters within the feature may occur (depending on depth, degree of turbulence within the body, biological activity, etc.). As such, sampling in standing water bodies may require collection of samples from discrete intervals, or compositing across the entire depth interval, to acquire data representative of conditions within the surface water body.

### 2.0 EQUIPMENT AND SUPPLIES

The following equipment may be used, depending on site-specific circumstances, to collect surface water samples:

- Sample location map;
- Measuring tape to assist in locating desired sample location;
- Field notebook and/or appropriate monitoring and sampling forms;
- Sample bottles/containers with cooler, ice, and Chains-of-Custody (COCs);
- Surface-water flow meter (optional);
- Field parameter monitoring equipment with calibration solutions (e.g. temperature, conductivity, pH, oxidation-reduction potential [ORP], salinity, turbidity, dissolved oxygen, etc.);
- Sample collection device, including but not limited to
  - Dip sampler device
  - Pond or cup sampler
  - Weighted bottle sampler
  - Discrete depth sampler (e.g. Kemmerer Depth Sampler or Bacon Bomb Sampler)
  - Grab sampler
- Decontamination supplies (e.g. detergent, solvents, potable and deionized water);

- U.S. Coast Guard-approved flotation device;
- Rescue line;
- Waders or boat.

### 3.0 METHODOLOGY

Samples should be taken from the “downstream” side (if applicable) of the sample location to prevent sample disturbance and cross contamination. The sampling may be conducted with nothing more than the appropriate sample container. However, as surface water becomes deeper and/or fast flowing, additional specialized equipment may be necessary. In general, surface water sampling should be completed as follows.

- Identify locations for sampling, and prepare to sample from downstream to upstream;
- Measure the total depth of the surface water body at the proposed sampling point by means of a weighted tape or other appropriate device;
- For flowing bodies of water, measure the flow velocity by means of a flow meter (optional);
- Carefully access the sample location (by wading or by boat), and begin sampling at the downstream location and work towards the upstream location to avoid entraining disturbed sediments in the sample;
- Once at the desired sampling point, carefully fill the sample container(s) or collection device by submerging the appropriately-selected sampling device/container below the surface of the stream at a point upstream of where the sampler is standing. If the laboratory-supplied sample containers are being filled directly, do not completely fill by submerging sample bottles containing preservatives: once the container is partially filled, the container lid can be used as a scoop to finish filling the preserved sample container. If sampling from discrete depth intervals, sample from shallow to deep;
- Complete measurements of appropriate field parameters (e.g. temperature, conductivity, pH, ORP, salinity, turbidity, dissolved oxygen, etc.) during sampling by appropriate methods;
- Once all necessary sample containers have been filled, move to the next sampling point. If sampling devices are utilized, complete appropriate decontamination procedures before initiating sampling of each subsequent sampling point;

- Prepare all sample containers according to appropriate management procedures (e.g. labeling, preservation, etc.), and record all sampling information in the project field notebook, sampling forms, and COCs.; and
- Record location of sample collection activities (e.g. location within surface water body, sample depth, distance from shore, etc.).



## #146 - PHOTO IONIZATION DETECTORS

The purpose of this section is to provide general guidelines for the use of photo ionization detectors (PIDs). Key generally uses two models of the HNu™: HW-101 and PI-101. The HNU is a portable, nonspecific, vapor/gas detector employing the principal of photo ionization to screen for a variety of volatile organic compounds in air.

PIDs are typically used to screen for volatile organic vapors in air to determine whether or not Site workers are to use breathing protection during Site activities. If specified in the project work plan, the PID may be used to measure the concentration of organic compounds in sample headspace to assist in the selection of samples to be submitted for laboratory analysis.

PIDs may be susceptible to impacts of temperature and high humidity; therefore, alternative air monitoring devices (*e.g.*, Draeger tubes) which are less sensitive to the effects of high humidity may need to be maintained on-Site.

### Definition:

An instrument that measures the concentration of trace gases present in the atmosphere by photo-ionizing molecules with an ultraviolet (UV) lamp and measuring the current generated by ions at a collection point in the ionization chamber.

Detailed operating instructions are in the operations manual which should be kept with the unit at the Site for reference. The HNu™ may need to have the battery recharged for approximately eight hours following a use of six to eight hours. The user should check the battery charge at the end of each work day to determine if recharging is necessary. The HNu™ should be calibrated at least annually, by the manufacturer, to a benzene standard. Various gases are available for daily calibration purposes; isobutylene is currently the most frequently used calibration gas. There are three commonly available UV lamps, 9.5, 10.2, and 11.7 electron volts (eV), which may be selected based on the ionization potential of the constituents of interest (See HNu™ Operations Manual). Key maintains both the 10.2- and 11.7-eV lamps. Both the calibrant and the lamp should be selected on a site-specific basis. The probe should be calibrated daily, after a warm-up period of approximately 20 minutes.

During operation, the background level should be set at 0 using the 1 to 20 scale. The needle may drift below 0 if the lamp is extinguished, when weather conditions are not favorable to operation, or there is an oxygen deficiency in the ambient air near the probe (particularly below 50 degrees Fahrenheit and if there is precipitation; during headspace analysis, condensate in the jar causes the needle to drift in this manner).

Gas vapor concentrations will vary due to mixing with ambient air during screening. Consequently, the range, not just the peak level, should be identified in the field notes and reports.

## **Air Monitoring**

Monitoring for VOCs will be conducted prior to and during all intrusive site activities, confined space entries, monitoring well inspection and/or sampling and any other field activities where inhalation may occur. Measurements should be taken in the breathing zone periodically to monitor for organic vapors. If the organic vapor levels exceed the air monitoring action levels (for the constituents listed in the project specific health and safety plan) for a sustained period greater than five minutes, ventilate the immediate work area, employ vapor suppression techniques or work upwind of the contamination. If these methods are not feasible or do not reduce the potential exposure below the acceptable levels, then employees must upgrade to Level C protection if benzene is not present. If benzene is present above the action level of 1 ppm, stop work, cover the area, and contact the Project Manager.

## **Transportation**

The HNu™ can be transported by a common carrier (ground or air) without additional documentation. As the instrument is delicate, it should be carefully packaged for handling.

## **Decontamination**

Decontamination should be performed on an as-needed basis (the equipment should never be in direct contact with the media of interest other than air). The procedure should incorporate a clean cloth and distilled water only (*i.e.*, no solvents).

## SOP 154 –DNAPL Sample Collection

### 1.0 SCOPE AND PURPOSE

This Standard Operating Procedure (SOP) describes the procedures associated with the collection of dense non-aqueous phase liquid (DNAPL) samples from monitoring wells and DNAPL recovery wells. Collection of DNAPL samples may be conducted to allow for testing to determine physical properties and/or chemical composition of a DNAPL. DNAPL samples may also be required for specialized testing of porous media (*i.e.*, threshold entry pressure). Collection and testing of DNAPL samples may also be performed to for waste classification purposes or to evaluate the feasibility of reuse of recovered DNAPL in industry. DNAPL physical properties (*i.e.*, density, viscosity and interfacial tension) may be determined to evaluate the mobility of a DNAPL in the subsurface. The chemical composition of a DNAPL may provide information regarding the effective solubility of individual DNAPL constituents.

### 2.0 REQUIRED MATERIALS

The type of equipment used for DNAPL sample collection will be somewhat dependent upon site conditions. Required materials may include the following:

- X Bottom filling bailers and sufficient length cord;
- X Peristaltic pump and sufficient length of tubing;
- X Personal protective equipment (as required by the Site Health and Safety Plan, or HASP);
- X Sample containers (clear glass with Teflon-lined cap);
- X UN Certified packaging containers available from HAZMATPAC, Inc. in Houston, Texas or equivalent;
- X Chain-of-Custody forms;
- X Sample cooler;
- X Bubble wrap or other suitable packing material;
- X "Blue Ice" (*i.e.*, reusable, freezable ice packs) or bagged ice
- X Shippers Airbills;
- X Packaging tape; and,

X Zip lock plastic bags.

### 3.0 METHODOLOGIES

The methodology required for collection of DNAPL samples will be dictated by project specific requirements and conditions. For example, at sites where active DNAPL recovery is ongoing, dedicated pumping equipment for DNAPL collection may be installed in the wells and samples may be collected from sample ports in the discharge line. The use of dedicated disposable sampling equipment is recommended for DNAPL sample collection; thus, bottom filling bailers or peristaltic pumps with dedicated tubing should be used, where possible. In this manner, field decontamination of sampling equipment is not necessary and potential contact with the DNAPL is minimized.

Manufacturer's information should be reviewed to ensure that bailers or pump tubing are chemically compatible with the DNAPL of interest. Personal protective equipment (safety glasses, gloves and chemical resistant coveralls) should be worn during sample collection.

The following procedure is recommended for DNAPL sample collection:

- 1) Measure the depth to DNAPL and DNAPL thickness using an oil/water interface probe.
2. Collect an appropriate volume of DNAPL using either a bailer or peristaltic pump. If a bailer is used, the device should be lowered and raised within the well very slowly to minimize agitation.. Approximately 150 ml minimum volume will be required for physical properties testing. Required sample volumes for chemical composition analysis and porous media characteristics should be determined in consultation with the testing laboratory.
3. The sample should be placed in an appropriate sized clear glass container with a Teflon-lined lid. Groundwater, from the same well from which the DNAPL was collected, should be added on top of the DNAPL to allow for performance of interfacial tension testing, if desired. No headspace should be left within the sample container.
4. The DNAPL sample container should be placed within certified packaging such as that available from HAZMATPAC, Inc. of Houston, Texas. The certified packing should in turn be placed within a sealed and secured sample cooler with ice for transport to the testing facility.
5. Due to the small volume of material being collected, special shipping procedures typically do not apply. However, prior to sample shipment via commercial carrier, a dangerous goods expert with the carrier should be consulted to determine any specific packaging and/or labeling requirements.

## **APPENDIX F**

### **CURRICULA VITAE OF KEY PERSONNEL**

## PROFESSIONAL RESUME

**JAMES S. ZUBROW**  
**Principal Hydrogeologist/Project Manager**

**Education:** ➤ B.A., Geology and Chemistry, University of Colorado, 1984

**Professional Registrations:** ➤ Professional Geologist, Commonwealth of Pennsylvania  
➤ Professional Geologist, State of Wisconsin  
➤ Professional Geologist, State of Texas

**Experience Summary:** Over nineteen years of experience in conducting and managing environmental projects pursuant to RCRA, CERCLA, and similar state statutes. Specialized in hydrogeologic investigations, feasibility studies, and hydrogeologic aspects of remedial design and remedy implementation. Provides project management on multi-disciplinary (i.e., hydrogeology, engineering and risk assessment) investigation, remedy evaluation and selection, remedial design and remedy implementation projects.

**Key Projects:** ➤ Project Manager for the preliminary assessment of 18 suspected former waste disposal areas in Pennsylvania. The project involved the gathering of historic information, review of aerial photography, performance of a site reconnaissance and preparation of a summary report to evaluate the need for further site characterization or remediation at each site. As part of this project, cost estimates for investigation and remediation of each individual site, if necessary, were prepared to assist the client with budgetary forecasting.

➤ Principal Hydrogeologist for Remedial Design and Remedial Action at a 155-acre former Coke and By-Products (i.e., coal tar processing) Plant in New Jersey. The remedy completed in 1999 involves capping, containment of coal tar DNAPL and containment and natural attenuation of dissolved coal tar constituents in groundwater. As part of the Remedial Design, a numerical groundwater and fate and transport model (MODFLOW/MT3D) was utilized to support the selection of a natural attenuation remedy. The Remedial Design also qualitatively evaluated the potential for remobilization of DNAPL based on predicted changes to the hydrogeologic regime resulting from the construction of the capping and containment components of the site remediation.

- Project Manager for the Remedial Design/Remedial Action Work Plan preparation for a former creosote wood treating facility in New Jersey. Pre-design activities included the delineation of creosote DNAPL using laser induced fluorescence. The results of this work demonstrated that the creosote has not migrated to depths greater than 8 feet below ground surface. In situ stabilization was selected as the source area remedy with monitored natural attenuation for the dissolved plume. The Remedial Action Work Plan was approved by NJDEP in February 1999 and implementation of the in situ stabilization source area remedy has been completed.
- Technical expert supporting a PRP in an Alternative Dispute Resolution proceeding for determining cost allocation related to the investigation and remediation of a CERCLA Site that was formerly a creosote wood treating facility, a manufactured gas plant and a coke and by-products plant. Also, provided services related to review and comments on the draft RD/RA Consent Decree and Statement of Work and technical review of groundwater pilot study deliverables.
- Project Manager for the Remedial Design/Remedial Action Work Plan preparation for a former creosote and CCA wood treating facility in New Jersey. In situ stabilization was selected as the source area remedy with monitored natural attenuation for the dissolved plume. The project involved the use of the laser-induced fluorescence technology to evaluate the extent of DNAPL in shallow and deeper water bearing units. The Remedial Action Work Plan was submitted to NJDEP in March 1999 and the remedy has been successfully implemented.
- Project Manager for implementation of a Response Action Plan (RAP) at a CERCLA former creosote wood treating site in Virginia (EPA Region III). Potential constituents of concern at this site include polynuclear aromatic hydrocarbons and benzene. The project involved the use of the laser-induced fluorescence technology to evaluate the extent of DNAPL in shallow and deeper water bearing units.
- Project Manager for a CERCLA remedial design at an inactive wood preserving plant in Texas, EPA Region VI. Project responsibilities included management of the design of a groundwater collection and dense non-aqueous phase liquid recovery system. The remedial design was approved by EPA in January 1995 and the recovery system constructed in the summer of 1995. The constituents of interest are creosote constituents, volatile aromatic compounds, arsenic and chromium. Recently, KEY completed groundwater fate and transport modeling to support discontinuation of the hydraulic containment (i.e. groundwater pump and treat) component of the groundwater remedy.

- Project Manager for the Remedial Design/Remedial Action for soil and groundwater at an inactive CERCLA wood treating site in Texas. The Soil Remedial Action was completed during 1997. A pilot study and remedial design that evaluated and recommended innovative DNAPL recovery approaches which minimize the amount groundwater produced during DNAPL recovery was completed in 1998. The pre-design investigation for this site included delineation of “potentially recoverable” DNAPL that was used to successfully reduce the size of the areas targeted for remediation. The construction of the full scale DNAPL Recovery System was completed in June 2002.
- Project Manager for a Demonstration of the Technical Impracticability of DNAPL Removal at a former wood treating facility in Texas. This work was implemented pursuant to an Agreed Order with the state regulatory agency. The work involved the use of existing Site information (including fate and transport modeling) in conjunction with general information regarding the impracticability of DNAPL removal and effective natural attenuation of creosote constituents. A natural attenuation remedy for site groundwater was approved by the State agency and groundwater monitoring is currently being conducted. The constituents of interest include coal tar constituents, pentachlorophenol, volatile aromatic compounds, arsenic, chromium and zinc.
- Project Manager for a RCRA Facility Investigation for two solid waste management units at a chemical manufacturing facility in West Virginia, EPA Region III. The project involves negotiation of a final scope of work with EPA Region III, implementation of the field investigation, risk assessment, data validation, and report preparation. The primary constituents of interest at this site include volatile aromatic compounds and metals.
- Project Manager for preparation of a RCRA Closure Plan for an inactive interim-status surface impoundment at a former coal tar distillation facility in Texas. The Closure Plan presents an approach for completion of closure in accordance with the Texas Risk Reduction Standards, such that post-closure care will not be required.
- Project Manager for preparation of a RCRA Closure Plan for an inactive interim-status container storage facility (CSF) in EPA Region IX. The Closure Plan presents an approach to completing clean closure of the unit through the removal and off-site disposal of the CSF asphalt pad. Surficial soils from beneath the pad will be analyzed to assess attainment of clean closure criteria. Stipulated clean closure criteria may include site-specific background, EPA Region IX risk-based criteria or site-specific risk-based criteria. In March 1997, the Closure Plan was approved by EPA without comment or need for revision.



- Project Manager for implementation of a RCRA Closure Plan for an inactive interim-status container storage facility (CSF) in Ohio. The project involved analysis of subsurface soils and a statistical comparison of the data to site-specific background data. The use of statistical procedures other than those presented in the OEPA Closure Guidance was necessary to support clean closure. Justification for the selected statistical procedures was presented in the Closure Report which has been approved by the OEPA without comment or need for revision.
- Project Manager for the site investigation and risk assessment under the Ohio Voluntary Action Program at a chemical manufacturing facility in Cleveland, Ohio. The client received a No Further Action decision and Covenant Not-to-Sue, based of the results of a probabilistic risk assessment.
- Project Manager for a pre-design investigation at a permitted RCRA Facility in Georgia. The project involved focused soil sampling and analysis, management of historic analytical data in a GIS/KEY data base, use of geostatistical techniques to define constituent distribution in soils, development of soil clean-up criteria and delineation of areas to be addressed by the soil corrective action. The primary constituents of interest at this site include arsenic and chromium.
- Pre-design Investigation and Groundwater Management Task Manager for a CERCLA remedial design at a wood preserving plant in Florida, EPA Region IV. Project responsibilities include: the management of all field investigative activities, including subsurface soil sampling, monitoring well and pumping test well installation, aquifer testing and groundwater sampling; and the design of a groundwater extraction system. The constituents of interest are creosote constituents, pentachlorophenol, volatile aromatic compounds, arsenic and chromium.
- Project manager for a CERCLA Remedial Investigation at a former wood preserving plant in North Carolina, EPA Region IV. Project involved the delineation of the extent of pentachlorophenol migration in groundwater occurring in fractured bedrock, and the evaluation of soil quality in the former treating, chemical handling, and lagoon areas. Served as managing hydrogeologist prior to becoming project manager.
- Project manager for an RCRA RFI/CMS at an operating wood preserving plant in Colorado, EPA Region VIII. Project activities included the delineation of site-related constituents in soil and groundwater; geotechnical evaluations for feasibility study purposes; and the preparation of a work plan for interim measures. Chemicals of interested included coal tar constituents, pentachlorophenol, volatile aromatic compounds,

arsenic and chromium. Served as managing hydrogeologist for project prior to becoming project manager.

- Project manager for the preparation of a RCRA RFI/CMS Work Plan at an active coke production facility in Alabama, EPA Region IV. Compounds of interest at this site included coal tar constituents, volatile aromatic compounds, arsenic, cyanide and selenium.
- Project Manager for groundwater monitoring activities for a municipal waste landfill in Pennsylvania. Project involves management of all data in a GIS/Key database and completion of statistical data evaluation using ANOVA procedure.

**Professional  
Affiliations:**

- Association of Groundwater Engineers and Scientists

**Publications:**

- Hale, J. R., Foos, A., Zubrow, J. S., Cook, J., 1997, Better Characterization of Arsenic and Chromium in Soils: A Field Scale Example: *Journal of Soil Contamination*, Volume 6, Number 4.
- M. King, R. Hickman, J. Zubrow, M. Lahr, R. Korbini, 1998, *Evaluation of a Novel Natural Attenuation Scenario*, Published in the Proceedings from the Fifth In Situ and On-Site International Bioremediation Symposium, San Diego, California April 19-22, 1999.

## PROFESSIONAL RESUME

**MATTHEW SWEET**  
**Staff Geologist**

**Education:** ➤ B.S., Geology, Rutgers College, Rutgers University, New Jersey, 2001

**Professional Registrations:** ➤ NJDEP Certified Subsurface Investigator

**Experience Summary:**

Over four years of experience in conducting and coordinating multi-phase environmental projects pursuant to ISRA, RCRA, and CERCLA statutes, as well as consulting oversight for a variety of construction, landfill capping, and geotechnical related projects; participated in full service chemical oxidation 'hot-spot' remediation and feasibility studies. Technical experience includes environmental and geotechnical investigations, drilling, test-pitting, remediation system design and build assistance, groundwater sampling, contouring, and reporting.

**Key Projects:**

- Project Geologist cooperating on ongoing remedial activities involving reclamation and redevelopment of a former wood treating facility in Port Reading, New Jersey. On-going remedial activities include groundwater sampling, reporting, subsurface investigation, environmental quality assurance and control regarding the importation of construction material, construction site inspection and documentation, as well as surface water studies.
- Project Geologist and Field Manager for full Remedial Investigation pursuant to NJDEP ISRA statutes at a former electronics manufacturing facility in New Providence, New Jersey. Remedial Investigation for DNAPL contamination included surface water sampling, sediment sampling, shallow and deep overburden monitoring well installation, bedrock well installation, and development.
- Staff Geologist for Interim Remedial Activities for a former wood treating facility in Port Newark, New Jersey; includes groundwater sampling, measurement, DNAPL monitoring and extraction, and reporting.
- Staff Geologist for Interim Remedial Activities at a former wood treating facility in Kearny, New Jersey; tasks include semi-annual groundwater monitoring activities, DNAPL measurement, as well as geotechnical studies of stockpiled processed dredge material.

- Staff Geologist, performed remedial investigation activities at an active wood treating facility in Montgomery, Pennsylvania; tasks include drilling and installation of monitoring wells, development, slug testing on-Site wells.
- Staff Geologist assist in remedial investigation performed on CERCLA site in Virginia, tasks included extensive groundwater sampling.
- Staff Geologist responsible for construction oversight on a landfill capping project in Middlesex County, New Jersey, tasks include contractor coordination, daily reports and event documentation, and surveying of storm swale inverts.
- Staff Geologist responsible for several Phase 1 site assessments involving the collection of historical information, tax and lot information, Sanborn map review, regulatory list search and review, and drafting of final report.
- Project Geologist for Chemical Oxidation contractor involved in the proprietary injection of hydrogen peroxide and potassium/sodium permanganate to remediate source area contamination on several Department of Defense, Department of Energy, CERCLA, and NJDEP ISRA Sites. Tasks included site reconnaissance, injector installation, feasibility studies, pilot studies, remedial action, equipment transport, maintenance, and final reporting.
- Staff Geologist for geotechnical engineering company responsibilities included nuclear density and sand cone soil density tests, grain size analysis, construction oversight, thorough documentation, and client contact.

## PROFESSIONAL RESUME

**JOHN E. FRANCIS, CIH, CSP**  
**Environmental, Health and Safety Manager**

**Education:**

- M.S., 1987, Environmental and Occupational Health, University of Pittsburgh Graduate School of Public Health
- B.S., 1971, Biology, Siena College, Albany, New York

**Professional  
Certifications:**

- Certified Industrial Hygienist
- Certified Safety Professional

**Experience  
Summary:**

- Serves as Environmental, Health and Safety Manager and Senior Compliance Specialist for an environmental engineering firm near Pittsburgh, Pennsylvania.

- Conducts audits and inspections on EPA and OSHA compliance issues and assists clients in establishing compliance management systems, written programs and procedures, and training.
  - Conducts audits and inspections on OSHA and EPA compliance issues and assists clients in establishing management systems, written programs and procedures, and training.
  - Assisted a major tooling and engineered components facility prepare for upcoming corporate audit by establishing residual and hazardous waste management programs. Prepared waste and chemical inventory reports.
  - Prepares written environmental and health and safety programs and plans and conducts requisite training for the company as well as for industrial clients and other environmental firms.
- Served as Principal Scientist for an environmental consulting firm near Pittsburgh, Pennsylvania.
  - Conducted environmental, health and safety audits and inspections for commercial, industrial and educational institution clients for client self-evaluation and in support of preparing spill and emergency response plans and preparing air, water, and waste permits and reports.

- Conducted environmental site surveys and audits and inventories and prepared EPA chemical inventory and toxic chemical release reports.
  - Prepared waste management program for a steel company to simplify recording requirements and conducted RCRA training for employees.
  - Prepared written programs and conducted employee and management training on environmental and OSHA issues.
  - Performed Phase I Site Assessments and additional health and safety and environmental investigations related to property transfers.
  - Performed indoor air quality investigations for industrial clients, hospital office building, and a community college.
- Served as the President of an industrial hygiene and safety consulting firm in Cranberry Township, Pennsylvania for five and one-half years with the following responsibilities:
- Conducted industrial hygiene and safety audits and mock OSHA inspections.
  - Performed chemical and noise exposure monitoring for industrial clients.
  - Prepared written health and safety programs and plans and conducted requisite training for industrial clients, environmental firms and others.
- Served as the Health and Safety and Quality Assurance Officer for an environmental firm in Pittsburgh, Pennsylvania for three years with the following responsibilities:
- Overall management of all health and safety policies, programs, and activities.
  - Prepared all site-specific health and safety plans, medical surveillance plans, air monitoring protocols, accident investigations, worker's compensation and loss control as well as health and safety training of employees.

- Served as Construction Quality Assurance Officer for remediation activities preparing Quality Assurance Plans, supervised field quality assurance personnel, conducted field and administrative quality assurance inspections, audits and reviews to ensure compliance with contract documents, specifications, and drawings.
- Served as a Environmental and Safety Manager for Alcoa Separations Technology, Inc. in Warrendale, Pennsylvania for two years with the following responsibilities:
  - Managed the development and implementation of comprehensive environmental, safety, and industrial hygiene programs for four U.S. locations.
  - Provided technical knowledge base on safety, industrial hygiene, and environmental regulations and issues affecting the company. Coordinated environmental objectives and compliance reporting at all locations.
- Served as an Environmental/Industrial Hygiene Specialist for an environmental services company in Warrendale, Pennsylvania for a period of three years with the following responsibilities:
  - Prepared PPC plans, client reports, and NPDES permits. Advised clients and conducted training on OSHA, EPA, RCRA, and CERCLA/SARA compliance.
  - Conducted Phase I property assessments for a variety of clients.
  - Developed safety and health plans and medical surveillance program for hazardous waste projects. Assisted in environmental audits/site investigations.
- Served as a Product Engineer in the Chemical Equipment Department for a chemical manufacturing facility in Pittsburgh, Pennsylvania for a period of one year and provided the sales force with the proper product delivery systems, analyzers, and application information to meet customer needs.
- Served as an Operations Specialist in the Activated Carbon Division for a water and air treatment company in Pittsburgh, Pennsylvania for three years with the following responsibilities: Installed, operated and maintained industrial wastewater treatment systems at customer sites.
- American Industrial Hygiene Association (National and Pittsburgh Chapters)

**Professional  
Affiliations:**

**VOLUME III of III**

**ATTACHMENT 1**



**ATTACHMENT 1**

**(REMEDIAL INVESTIGATION DATA)**

**TO**

**INTERIM RESPONSE ACTION WORKPLAN (IRAW)**

**STANDARD CHLORINE CHEMICAL COMPANY SITE  
AND DIAMOND SITE  
KEARNY, NEW JERSEY**

*Prepared for:*

**The Peninsula Restoration Group**  
**(Standard Chlorine Chemical Company, Tierra Solutions, Inc. and Beazer East, Inc.)**

*Prepared by:*

**Key Environmental, Inc.**  
200 Third Avenue  
Carnegie, Pennsylvania 15106

**May 2007**

# ATTACHMENT 1

## TABLE OF CONTENTS

### Sample Location Maps

#### Section A - SCCC Site Data

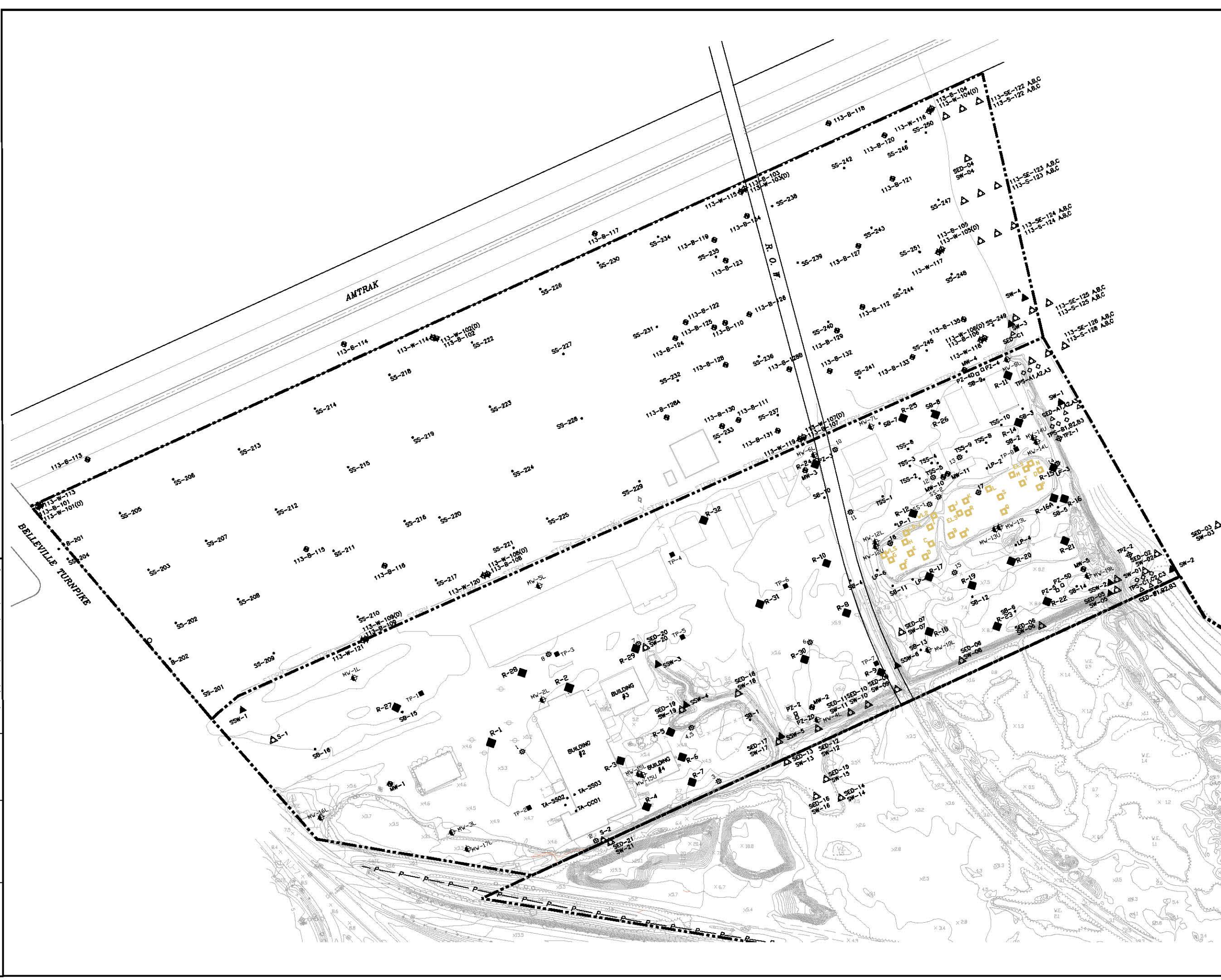
- **A.1 Lagoon Sludge Data**
  - 1983-1984 Hydrogeologic Investigation
  - 1985 Phase II Dioxin Site Investigation
  - 1985-1988 Stage I, II, and III Dioxin Investigation
  - 1990-1993 Remedial Investigation
- **A.2 Soil Data**
  - 1983-1984 Hydrogeologic Investigation
  - 1985 Phase II Dioxin Site Investigation
  - 1985-1988 Stage I, II, and III Dioxin Investigation
  - 1991 Interim Remedial Measures Sampling
  - 1990-1993 Remedial Investigation
  - 1996-1997 Focused Remedial Investigation
  - 1997-1999 Supplemental Remedial Investigation
- **A.3 Groundwater Data**
  - 1983-1984 Hydrogeologic Investigation
  - 1990-1993 Remedial Investigation
  - 1997-1999 Supplemental Remedial Investigation
- **A.4 Bedrock Groundwater Data**
  - 1997-1999 Supplemental Remedial Investigation
- **A.5 DNAPL Data**
  - 1996-1997 Focused Remedial Investigation
- **A.6 Surface Water/Sediment Data**
  - 1990-1993 Remedial Investigation
  - 1996-1997 Focused Remedial Investigation
  - 2000 Remedial Action Workplan
  - 2002 EPA Superfund Contract Support Team Sampling Report
- **A.7 Transformer Area Data**
  - 1990-1993 Remedial Investigation
  - 1997-1999 Supplemental Remedial Investigation

#### Section B - Diamond Site

- **B.1 Soil and Sediment Data**
  - 1989-2001 Remedial Investigation
- **B.2 Groundwater and Surface Water Data**
  - 1989-2001 Remedial Investigation

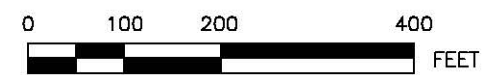
### **Sample Location Map**

FILE: Y:\Kearny\06-248\Kearny 2006\Draw\Fig\_A-1.dwg  
VERSION: ACAD 2000  
MACH: PC  
LAYOUT: PAR-05



# LEGEND

- PROPERTY BOUNDARY
- FENCE
- 8# SURFACE SOIL SAMPLE (WESTON)
- SS-1# SURFACE SOIL SAMPLE (WESTON)
- B, LD-1, WL2, ELS LAGOON SAMPLES (WESTON)
- MW-1L# MONITORING WELL (ERM)
- PZ-3# PIEZOMETER LOCATION
- LP-5# SOIL BORING SAMPLE LOCATION (WESTON)
- SB-3# SOIL BORING SAMPLE LOCATION (ERM)
- SS-224# SURFACE SOIL SAMPLE LOCATION (BROWN & CALDWELL)
- TSS-1# TANK SURFACE SOIL SAMPLE LOCATION (WESTON)
- TA-SS01# SOIL SAMPLE LOCATION (KEY)
- TA-C001# PCB/SOIL SAMPLE LOCATION
- A-SERIES (TPS-A1,A2,A3) SEDIMENT SAMPLE LOCATION (ESI)
- SED-A1,A2,A3 SEDIMENT SAMPLE LOCATION (ERM)
- 113-B-104, 113-W-104(D) SOIL(B)/GW(W) SAMPLE LOCATION (BROWN & CALDWELL)
- 113-W-118# SHALLOW GROUNDWATER MONITORING WELL
- MW-1# MONITORING WELL/SOIL BORING (WESTON)
- SW-4# SURFACE WATER SAMPLE LOCATION (ERM)
- SSW-1# SURFACE WATER AND SEDIMENT SAMPLE LOCATION (WESTON)
- SED-04, SW-04 SURFACE WATER AND SEDIMENT SAMPLE LOCATION (USEPA)
- 113-SE-122 A,B,C, 113-S-122 A,B,C SURFACE WATER AND SEDIMENT SAMPLE LOCATION (BROWN & CALDWELL)
- SURFACE WATER SAMPLE:
  - A = COLLECTED AT SURFACE ON SHORE EDGE
  - B = COLLECTED 40' OFFSHORE TOTAL WATER DEPTH 15'
  - C = COLLECTED 80' OFFSHORE TOTAL WATER DEPTH 25'
- TPZ-1# TEMPORARY MONITORING WELL LOCATION (WESTON)
- 16# SEDIMENT SAMPLE (E.C. JORDON)
- TP-1# TEST PIT LOCATION (WESTON)



PENINSULA RESTORATION GROUP

DRWN: ETF	DATE: 3-29-04	<b>KEY</b> ENVIRONMENTAL INCORPORATED
CHKD: SHR	DATE: 3-29-04	
APPD: JSZ	DATE: 3-29-04	
SCALE: AS SHOWN		

INTERIM RESPONSE ACTION WORKPLAN  
SCCC AND DIAMOND SITES  
KEARNY, NEW JERSEY

SAMPLE LOCATION MAP

PROJECT No. 06-248  
FIGURE A-1

## **A.1 Lagoon Sludge Data**

## 1983-1984 Hydrogeologic Investigation

Table 1-1

**Summary of Soil Sample Metals Analyses Results  
SCCC, Kearny, NJ (1983)**

Description	pH	Total Chromium		EP Toxicity Test Leachate							
		Chromium mg/kg	Hexavalent Chromium mg/kg	As mg/l	Ba mg/l	Cd mg/l	Cr mg/l	Pb mg/l	Hg mg/l	Se mg/l	Ag mg/l
1D: 5-7' fill	NA	150	ND	ND	0.81	ND	ND	ND	ND	ND	ND
1D: Meadow mat	7.7	3	ND	ND	0.56	ND	ND	ND	ND	ND	ND
1D: 15-16' sand	NA	6	ND	ND	0.17	ND	ND	ND	ND	ND	ND
2D: 5-7' fill	12.3	31,100	14.4	ND	0.68	ND	16	ND	ND	.018	ND
2D: Meadow mat	11.7	16,500	0.7	ND	0.019	ND	3.23	ND	ND	ND	ND
2D: 13' silt	NA	82	ND	ND	0.34	ND	ND	ND	ND	ND	ND
2D: 13-15' sand	NA	48	ND	ND	0.15	ND	ND	ND	ND	ND	ND
3D: 2-3' fill	12.2	31,000	5.7	ND	0.62	ND	5.44	ND	ND	.017	ND
3D: 5-7' fill	11.4	745	ND	ND	0.51	ND	ND	ND	ND	ND	ND
3D: Meadow mat	8.2	9,900	ND	ND	0.54	ND	0.87	ND	ND	ND	ND
3D: 12-13' sand	NA	10	ND	ND	0.16	ND	ND	ND	ND	ND	ND
4D: Meadow mat	8.1	770	ND	ND	0.46	ND	ND	ND	ND	ND	ND
4D: 15-17' sand	NA	49	ND	ND	0.19	ND	ND	ND	ND	ND	ND
4D: 15-17' sand	5.7	36	ND	ND	0.19	ND	ND	ND	ND	ND	ND
5D: 5-7' fill	12.2	18,000	38.0	ND	0.43	ND	43.6	ND	ND	.013	ND
5D: Meadow mat	8.7	7,600	ND	ND	0.78	ND	3.08	ND	ND	ND	ND
5D: 17-19' sand	NA	12	ND	0.051	0.07	ND	0.41	ND	ND	ND	ND
Lagoon 1	NA	7,700	ND	ND	0.30	ND	0.41	ND	ND	ND	ND
Lagoon 2	NA	6,400	ND	ND	0.11	ND	ND	ND	ND	ND	ND

ND = Not Detected

NA = Not Analyzed

## **1985 Phase II Dioxin Site Investigation**



Table 1-3

**Results of Phase II Dioxin Investigation  
SCCC, Kearny, NJ**

Sample Collection Date: 7 May 1985

Sample Analysis Date(s): 15, 16, and 17 May; 16 and 17 June 1985 Environmental  
Testing and Certification Corporation, Edison, New Jersey

Sample Number	2,3,7,8-TCDD (ppb <sup>1</sup> )		Sample Type
	Measured	DL <sup>2</sup>	
1	ND <sup>3</sup>	0.15	Surface soil
2	ND	0.60	Surface soil
3	ND <sup>6</sup>	0.037	Surface soil
4	ND	0.62	Surface soil
5	ND	0.42	Duplicate of Sample 4
6	ND	0.54	Surface soil
7	ND	0.67	Sediment
8	ND	0.23	Surface soil
9	ND	0.25	Field/equipment blank
10	ND	0.29	Surface soil
11	ND	0.16	Surface soil
12	0.52 <sup>4</sup>	--	Surface soil
13	ND	0.70	Surface soil
14	ND	0.62	Surface soil
15	ND	0.29	Surface soil
16	59.5 <sup>4</sup>	--	Sediment
17	-- <sup>5</sup>	--	Sediment
18	ND	0.11	Equipment blank
19	4.90	--	Proficiency

<sup>1</sup> ppb = Parts per billion. i.e., µg/kg of soil or sediment on an "as is" basis.

<sup>2</sup> DL = Method detection limit which is the concentration at which there is a 99 percent confidence level that the compound is present. ETC only reports detection limits for non-detect results.

<sup>3</sup> ND = Not detected.

<sup>4</sup> Repeat analysis, required for quality assurance review.

<sup>5</sup> Repeat analysis unsuccessful - failed surrogate recovery.

<sup>6</sup> Results of re-analysis by California Analytical Laboratories of West Sacramento, California, on 16 September 1985.

## **1985-1988 Stage I, II, and III Dioxin Investigation**

Table 1-4

Summary of 2,3,7,8-TCDD Concentrations in Soil  
 Samples Collected in August 1985  
 SCCC, Kearny, NJ

Sample	Depth (ft)	Detection Limit 2,3,7,8-TCDD (µg/kg)
<u>Riverbank</u> RB-2A	0-0.5	<0.07
RB-2C	1.5-2.0	<0.16
RB-3A	0-0.5	<0.10
RB-3B	1.5-2.0	<0.23
<u>Lagoon Perimeter</u> LB-1A	0-0.5	<0.05
LP-1B	1.5-1.7	<0.12
LP-2	0.5-WT	<0.67
LP-3A	0-0.5	<0.02
LP-3C	3.5-4.0	<0.17
LP-4A	0-0.5	<0.16
LP-4B	6.0-6.5	<0.15
LP-5A	0-0.5	<0.10
LP-5D	3.6-4.1	<0.01
LP-6A	0-0.5	<0.03
LP-6B	0.5-WT	<0.05
LP-7A	0-0.5	<0.09
LP-7B	1.7-2.1	<0.38
<u>Lagoon</u> LD-1	--	3.1/9.6 <sup>b</sup>
EL-1	0-0.5	<0.10
EL-1D	0-0.5	<0.10
EL-3	0-0.5	62.1
WL-2	0-0.5	<75.5 <sup>a</sup> /55.6 <sup>b</sup>
WL-2D	0-0.5	45.2
<u>Other Areas</u> 10A	0-0.5	5.0
12	1.5-2.0	<0.23
13	1.5-2.0	<0.13
NJ-01	--	<0.16
DP-1	--	<0.07

Note: Samples analyzed by Cal. Analytical. A, B, C, D indicate depths at the Riverbank, Lagoon Perimeter and Other Area locations. EL-1D is a duplicate sample.

WT = Water table.

<sup>a</sup> = Chemical interferences.

<sup>b</sup> = Duplicate analyses.

Table 1-5

Stage I Analysis Summary  
SCCC, Kearny, NJ

WESTON Sample Number	TCDD Measured (ppb)	TCDD Detection Limit (ppb)
Method Blank	ND	0.13
Method Blank	ND	0.092
S-1-SS	ND	0.41
R-1-SS	15.3	--
N-1-SS	ND	0.62
N-1-SS Dup	ND	0.49
L-1H-SS	0.71	--
E-1	0.85	--
I-1H	ND	1.1
P-1-SS	ND	0.60
O-1-SS	ND	0.33
O-FP-SS	ND	0.53
O-FP-SS-NS	9.2	--
B-1	8.2	--
J-1H	11.2	--
STDCL-1A	ND	0.25
STDCL-1B	9.2	--
C-2H-SS	0.23	--
C-2H-SS Dup	ND	0.45
M-1-SS	ND	0.36
K-1H-SS	69.6	--
O-1-SS	ND	0.56
O-1-SS-NS	8.2	--
O-1D-SS	ND	0.26
Method Blank	ND	0.12
Method Blank	ND	0.20
SS-1	ND	1.1
SS-2	ND	1.4
F-1	*	*
G-1	2.8	--
H-1	ND	0.73
D-1	ND	0.90
T-1-SS	ND	0.23
A-1	2.6	--
Method Blank	ND	0.034
T-2-SS	ND	0.21
S-2-SS	ND	0.076

Table 1-5 (continued)

WESTON Sample Number	TCDD Measured (ppb)	TCDD Detection Limit (ppb)
R-2-SS	62.1	--
E-2-SS	31.9	--
N-2-SS	ND	0.18
O-2-SS	ND	0.028
P-2-SS	ND	0.11
C-1	19.5	--
C-1 Dup	16.3	--
I-2-SS	3.2	--
I-3-SS	38.4	--
I-4-SS	6.2	--
D-2-SS	ND	0.053
G-2-SS	ND	0.12
B-2-SS	ND	0.11
M-2-SS	ND	0.084
K-2-SS	2.7	--
H-2-SS	ND	0.13
A-2-SS	ND	1.5
Q-2D-SS	ND	0.089
STDCL-2B	3.5	--
Method Blank	ND	0.087
I-1H NS	1.3	--
Method Blank	ND	0.19
Method Blank	9.4	--
WS-1	9.6	--
WS-2	ND	0.61
Method Blank	ND	0.17
Method Blank NS	9.6	--
RS-1	0.14	--
F-4-SS	4.3	--
J-2-SS	*	*
J-3-SS	*	*
J-4-SS	*	*

ND = Not Detected.

\* = Results of this sample analysis not reported due to crystallization of liquid phase following extraction.

Note: The samples collected were lagoon sediments except for the following: STDCL indicates EPA performance test; SS-1, SS-2 were surface soils; WS-1 was a wipe sample, foundation; WS-2 was a wipe sample, blank.

Source: WESTON, 1987

Table 1-6

**Stage II and III Analysis Summary  
SCCC, Kearny, NJ**

WESTON Sample Number	2,3,7,8-TCDD Measured (ppb)	2,3,7,8-TCDD Detection Limit (ppb)
Method Blank	ND	0.016
Method Blank	ND	1.6
MBNS	0.85	--
MBNS	0.83	--
R-3-SS	190	--
R-4-SS	46	--
R-4-SS Dup	43	--
E-3-SS	2.9	--
E-3-SS NJ	10.3	--
E-4-SS	1.2	--
F-1	2.3	--
O-2-SS	ND	0.35
K-4-SS	3.7	--
J-3-SS	268	--
J-3-SS	237	--
J-3-SS NJ	273	--
J-4-SS	148	--
K-3-SS	6.1	--
J-2-SS	*	*
STDCL-4B	6.8	--
STDCL-3A	9.9	--

ND = Not Detected.

\* = Results of this sample analysis not reported due to crystallization of liquid phase following extraction.

Note: The samples collected were lagoon sediments; STDCL indicates EPA performance tests; MBNS was a method blank; NJ is a samples split with NJDEP.

Source: WESTON, 1988

## 1990-1993 Remedial Investigation

**TABLE 5-1  
SUMMARY OF LAGOON SAMPLING DATA  
VOLATILES AND SEMIVOLATILES  
SCCC, KEARNY, NJ**

LAB NUMBER SAMPLE NUMBER MEDIUM	IIA3591 WLS-1 SEDIMENT		IIA3592 WLS-2 SEDIMENT		IIA3593 ELS-1 SEDIMENT		IIA3594 ELS-2 SEDIMENT		IIA3597 WLS-1 WATER		IIA3598 ELS-1 WATER	
	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.
<b>VOC Compound (ug/kg)</b>									<b>(ug/L)</b>			
Benzene	ND	15000	BMDL	4100	896	670	23400	6700	ND	4.4	ND	22.0
Chlorobenzene	ND	20000	ND	5600	ND	910	ND	9100	BMDL	6.0	77.6	30.0
Ethylbenzene	39600	24000	15200	6700	2580	1100	43300	11000	ND	7.2	ND	36.0
Methylene Chloride	21500	9300	6090	2600	438	420	5330	4200	ND	2.8	ND	14.0
Toluene	33800	20000	15300	5600	3050	910	63100	9100	ND	6.0	BMDL	30.0
<b>BNA Compound (ug/kg)</b>									<b>(ug/L)</b>			
Acenaphthene	6070000	130000	2090000	170000	529000	5800	3650000	290000	ND	1.9	BMDL	1.9
Anthracene	1700000	130000	190000	170000	180000	5800	BMDL	290000	ND	3.6	ND	1.9
Benzo(a)anthracene	BMDL	520000	ND	720000	ND	24000	ND	1200000	ND	8.0	ND	8.0
Benzo(b)fluoranthene	BMDL	320000	ND	440000	ND	15000	ND	730000	ND	4.9	ND	4.9
1,2-Dichlorobenzene	ND	130000	ND	170000	22100	5800	ND	290000	BMDL	1.9	1.9	1.9
1,3-Dichlorobenzene	ND	130000	ND	170000	ND	5800	ND	290000	4.6	1.9	10.2	1.9
1,4-Dichlorobenzene	ND	290000	ND	400000	40000	13000	ND	660000	10.5	4.5	23.0	4.5
Fluoranthene	903000	150000	BMDL	200000	115000	6700	ND	330000	ND	2.2	ND	2.2
Fluorene	5150000	130000	717000	170000	587000	5800	604000	290000	BMDL	1.9	ND	1.9
Hexachlorobenzene	ND	130000	ND	170000	93500	5800	ND	290000	BMDL	1.9	ND	1.9
Naphthalene	2040000000	110000	300000000	150000	815000000	4800	25200000000	240000	12.7	1.6	3.1	1.6
Phenanthrene	5320000	360000	628000	500000	715000	16000	BMDL	820000	BMDL	5.5	BMDL	5.5
1,2,4-Trichlorobenzene	ND	130000	ND	170000	ND	5800	ND	290000	7.1	1.9	18.5	1.9
Pyrene	663000	130000	ND	170000	32200	5800	ND	290000	ND	1.9	ND	1.9
2,4-Dimethylphenol	21900000	180000	2770000	250000	17600000	8200	3490000	410000	11.1	2.8	154.0	2.8
Phenol	1210000	100000	12100000	140000	4220000	4500	14100000	230000	74.3	1.5	24.2	1.5
Phenolics	31.5	10.73	9.6	2.98	12.6	4.88	1.29	0.48	0.15	0.05	1.12	0.05

ND - Not detected

BMDL - Present below detection limit, estimated concentration not reported by laboratory



TABLE 5-1 (Continued)  
SUMMARY OF LAGOON SAMPLING DATA  
METALS  
SCCC, KEARNY, NJ

LAB NUMBER SAMPLE NUMBER MEDIUM	IIA3591 WLS-1 SEDIMENT		IIA3592 WLS-2 SEDIMENT		IIA3593 ELS-1 SEDIMENT		IIA3594 ELS-2 SEDIMENT		IIA3597 WLS-1 WATER		IIA3598 ELS-1 WATER	
	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.
<b>Metals (mg/kg)</b>									<b>(mg/L)</b>			
Antimony	ND	39.00	BMDL	11.00	BMDL	19.00	19.00	18.00	ND	0.0600	BMDL	0.0600
Arsenic	BMDL	33.00	BMDL	9.50	BMDL	3.10	5.10	3.00	ND	0.0100	BMDL	0.0100
Beryllium	ND	0.66	ND	0.19	ND	0.31	ND	0.30	ND	0.0010	ND	0.0010
Cadmium	BMDL	1.30	0.39	0.37	ND	0.62	BMDL	0.61	ND	0.0020	ND	0.0020
Chromium	200	6.60	521.00	1.90	767.00	3.10	2080.00	3.00	0.30	0.0100	2.8400	0.0100
Copper	480	6.60	66.00	1.90	200.00	3.10	64.00	3.00	ND	0.0100	0.0350	0.0100
Lead	970	49.00	1200.00	14.00	570.00	23.00	4270.00	23.00	BMDL	0.0750	0.3500	0.0750
Mercury	16	0.53	BMDL	0.15	4.50	0.11	3.10	0.24	BMDL	0.0002	0.0017	0.0002
Nickel	130	13.00	41.00	3.70	91.00	6.20	150.00	6.10	BMDL	0.0200	0.0220	0.0200
Selenium	BMDL	3.30	BMDL	0.94	ND	7.50	ND	7.50	ND	0.0050	ND	0.0050
Silver	BMDL	6.60	ND	1.90	ND	3.10	BMDL	3.00	ND	0.0100	ND	0.0100
Thallium	ND	6.60	ND	1.90	ND	16.00	ND	3.00	ND	0.0100	ND	0.0100
Zinc	ND	13.00	20.00	3.70	20.00	6.20	39.00	6.10	0.39	0.0200	0.3700	0.0200
Cyanide	58.70	3.33	98.70	0.93	12.58	1.50	14.30	1.50	ND	0.0250	ND	0.0250

ND - Not detected

BMDL - Present below detection limit, estimated concentration not reported by laboratory

## **A.2 Soil Data**

## 1983-1984 Hydrogeologic Investigation

Table 1-1

**Summary of Soil Sample Metals Analyses Results  
SCCC, Kearny, NJ (1983)**

Description	pH	Total Chromium		EP Toxicity Test Leachate							
		Chromium mg/kg	Hexavalent Chromium mg/kg	As mg/l	Ba mg/l	Cd mg/l	Cr mg/l	Pb mg/l	Hg mg/l	Se mg/l	Ag mg/l
1D: 5-7' fill	NA	150	ND	ND	0.81	ND	ND	ND	ND	ND	ND
1D: Meadow mat	7.7	3	ND	ND	0.56	ND	ND	ND	ND	ND	ND
1D: 15-16' sand	NA	6	ND	ND	0.17	ND	ND	ND	ND	ND	ND
2D: 5-7' fill	12.3	31,100	14.4	ND	0.68	ND	16	ND	ND	.018	ND
2D: Meadow mat	11.7	16,500	0.7	ND	0.019	ND	3.23	ND	ND	ND	ND
2D: 13' silt	NA	82	ND	ND	0.34	ND	ND	ND	ND	ND	ND
2D: 13-15' sand	NA	48	ND	ND	0.15	ND	ND	ND	ND	ND	ND
3D: 2-3' fill	12.2	31,000	5.7	ND	0.62	ND	5.44	ND	ND	.017	ND
3D: 5-7' fill	11.4	745	ND	ND	0.51	ND	ND	ND	ND	ND	ND
3D: Meadow mat	8.2	9,900	ND	ND	0.54	ND	0.87	ND	ND	ND	ND
3D: 12-13' sand	NA	10	ND	ND	0.16	ND	ND	ND	ND	ND	ND
4D: Meadow mat	8.1	770	ND	ND	0.46	ND	ND	ND	ND	ND	ND
4D: 15-17' sand	NA	49	ND	ND	0.19	ND	ND	ND	ND	ND	ND
4D: 15-17' sand	5.7	36	ND	ND	0.19	ND	ND	ND	ND	ND	ND
5D: 5-7' fill	12.2	18,000	38.0	ND	0.43	ND	43.6	ND	ND	.013	ND
5D: Meadow mat	8.7	7,600	ND	ND	0.78	ND	3.08	ND	ND	ND	ND
5D: 17-19' sand	NA	12	ND	0.051	0.07	ND	0.41	ND	ND	ND	ND
Lagoon 1	NA	7,700	ND	ND	0.30	ND	0.41	ND	ND	ND	ND
Lagoon 2	NA	6,400	ND	ND	0.11	ND	ND	ND	ND	ND	ND

ND = Not Detected  
NA = Not Analyzed

## **1985 Phase II Dioxin Site Investigation**

Table 1-3

**Results of Phase II Dioxin Investigation  
SCCC, Kearny, NJ**

Sample Collection Date: 7 May 1985  
 Sample Analysis Date(s): 15, 16, and 17 May; 16 and 17 June 1985 Environmental  
 Testing and Certification Corporation, Edison, New Jersey

Sample Number	2,3,7,8-TCDD (ppb <sup>1</sup> )		Sample Type
	Measured	DL <sup>2</sup>	
1	ND <sup>3</sup>	0.15	Surface soil
2	ND	0.60	Surface soil
3	ND <sup>o</sup>	0.037	Surface soil
4	ND	0.62	Surface soil
5	ND	0.42	Duplicate of Sample 4
6	ND	0.54	Surface soil
7	ND	0.67	Sediment
8	ND	0.23	Surface soil
9	ND	0.25	Field/equipment blank
10	ND	0.29	Surface soil
11	ND	0.16	Surface soil
12	0.52 <sup>4</sup>	--	Surface soil
13	ND	0.70	Surface soil
14	ND	0.62	Surface soil
15	ND	0.29	Surface soil
16	59.5 <sup>4</sup>	--	Sediment
17	-- <sup>5</sup>	--	Sediment
18	ND	0.11	Equipment blank
19	4.90	--	Proficiency

<sup>1</sup> ppb = Parts per billion. i.e., µg/kg of soil or sediment on an "as is" basis.

<sup>2</sup> DL = Method detection limit which is the concentration at which there is a 99 percent confidence level that the compound is present. ETC only reports detection limits for non-detect results.

<sup>3</sup> ND = Not detected.

<sup>4</sup> Repeat analysis, required for quality assurance review.

<sup>5</sup> Repeat analysis unsuccessful - failed surrogate recovery.

<sup>6</sup> Results of re-analysis by California Analytical Laboratories of West Sacramento, California, on 16 September 1985.

**1985-1988 Stage I, II, and III Dioxin Investigation**

Table 1-4

Summary of 2,3,7,8-TCDD Concentrations in Soil  
Samples Collected in August 1985  
SCCC, Kearny, NJ

Sample	Depth (ft)	Detection Limit 2,3,7,8-TCDD (µg/kg)
<u>Riverbank</u>		
RB-2A	0-0.5	<0.07
RB-2C	1.5-2.0	<0.16
RB-3A	0-0.5	<0.10
RB-3B	1.5-2.0	<0.23
<u>Lagoon Perimeter</u>		
LB-1A	0-0.5	<0.05
LP-1B	1.5-1.7	<0.12
LP-2	0.5-WT	<0.67
LP-3A	0-0.5	<0.02
LP-3C	3.5-4.0	<0.17
LP-4A	0-0.5	<0.16
LP-4B	6.0-6.5	<0.15
LP-5A	0-0.5	<0.10
LP-5D	3.6-4.1	<0.01
LP-6A	0-0.5	<0.03
LP-6B	0.5-WT	<0.05
LP-7A	0-0.5	<0.09
LP-7B	1.7-2.1	<0.38
<u>Lagoon</u>		
LD-1	--	3.1/9.6 <sup>b</sup>
EL-1	0-0.5	<0.10
EL-1D	0-0.5	<0.10
EL-3	0-0.5	62.1
WL-2	0-0.5	<75.5*/55.6 <sup>b</sup>
WL-2D	0-0.5	45.2
<u>Other Areas</u>		
10A	0-0.5	5.0
12	1.5-2.0	<0.23
13	1.5-2.0	<0.13
NJ-01	--	<0.16
DP-1	--	<0.07

Note: Samples analyzed by Cal. Analytical. A, B, C, D indicate depths at the Riverbank, Lagoon Perimeter and Other Area locations. EL-ID is a duplicate sample.

WT = Water table.

\* = Chemical interferences.

<sup>b</sup> = Duplicate analyses.



Table 1-5

Stage I Analysis Summary  
SCCC, Kearny, NJ

WESTON Sample Number	TCDD Measured (ppb)	TCDD Detection Limit (ppb)
Method Blank	ND	0.13
Method Blank	ND	0.092
S-1-SS	ND	0.41
R-1-SS	15.3	--
N-1-SS	ND	0.62
N-1-SS Dup	ND	0.49
L-1H-SS	0.71	--
E-1	0.85	--
I-1H	ND	1.1
P-1-SS	ND	0.60
O-1-SS	ND	0.33
O-FP-SS	ND	0.53
O-FP-SS-NS	9.2	--
B-1	8.2	--
J-1H	11.2	--
STDCL-1A	ND	0.25
STDCL-1B	9.2	--
C-2H-SS	0.23	--
C-2H-SS Dup	ND	0.45
M-1-SS	ND	0.36
K-1H-SS	69.6	--
O-1-SS	ND	0.56
O-1-SS-NS	8.2	--
O-1D-SS	ND	0.26
Method Blank	ND	0.12
Method Blank	ND	0.20
SS-1	ND	1.1
SS-2	ND	1.4
F-1	*	*
G-1	2.8	--
H-1	ND	0.73
D-1	ND	0.90
T-1-SS	ND	0.23
A-1	2.6	--
Method Blank	ND	0.034
T-2-SS	ND	0.21
S-2-SS	ND	0.076

Table 1-5 (continued)

WESTON Sample Number	TCDD Measured (ppb)	TCDD Detection Limit (ppb)
R-2-SS	62.1	--
E-2-SS	31.9	--
N-2-SS	ND	0.18
O-2-SS	ND	0.028
P-2-SS	ND	0.11
C-1	19.5	--
C-1 Dup	16.3	--
I-2-SS	3.2	--
I-3-SS	38.4	--
I-4-SS	6.2	--
D-2-SS	ND	0.053
G-2-SS	ND	0.12
B-2-SS	ND	0.11
M-2-SS	ND	0.084
K-2-SS	2.7	--
H-2-SS	ND	0.13
A-2-SS	ND	1.5
Q-2D-SS	ND	0.089
STDCL-2B	3.5	--
Method Blank	ND	0.087
I-1H NS	1.3	--
Method Blank	ND	0.19
Method Blank	9.4	--
WS-1	9.6	--
WS-2	ND	0.61
Method Blank	ND	0.17
Method Blank NS	9.6	--
RS-1	0.14	--
F-4-SS	4.3	--
J-2-SS	*	*
J-3-SS	*	*
J-4-SS	*	*

ND = Not Detected.

\* = Results of this sample analysis not reported due to crystallization of liquid phase following extraction.

Note: The samples collected were lagoon sediments except for the following: STDCL indicates EPA performance test; SS-1, SS-2 were surface soils; WS-1 was a wipe sample, foundation; WS-2 was a wipe sample, blank.

Source: WESTON, 1987

Table 1-6

**Stage II and III Analysis Summary  
SCCC, Kearny, NJ**

WESTON Sample Number	2,3,7,8-TCDD Measured (ppb)	2,3,7,8-TCDD Detection Limit (ppb)
Method Blank	ND	0.016
Method Blank	ND	1.6
MBNS	0.85	--
MBNS	0.83	--
R-3-SS	190	--
R-4-SS	46	--
R-4-SS Dup	43	--
E-3-SS	2.9	--
E-3-SS NJ	10.3	--
E-4-SS	1.2	--
F-1	2.3	--
O-2-SS	ND	0.35
K-4-SS	3.7	--
J-3-SS	268	--
J-3-SS	237	--
J-3-SS NJ	273	--
J-4-SS	148	--
K-3-SS	6.1	--
J-2-SS	*	*
STDCL-4B	6.8	--
STDCL-3A	9.9	--

ND = Not Detected.

\* = Results of this sample analysis not reported due to crystallization of liquid phase following extraction.

Note: The samples collected were lagoon sediments; STDCL indicates EPA performance tests; MBNS was a method blank; NJ is a samples split with NJDEP.

Source: WESTON, 1988

## 1991 Interim Remedial Measures Sampling

TA. - 02  
SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION  
PREVIOUS INVESTIGATIONS  
TOTAL AND HEXAVALENT CHROMIUM  
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	Depth (ft bgs)	Total Cr	Cr(VI)
SSW/SED-5	1/91	Weston	9	Sediment	mg/kg	NR	12,600	NR
SED-1	1/91	Weston	9	Sediment	mg/kg	NR	3,440	NR
SED-2	1/91	Weston	9	Sediment	mg/kg	NR	100	NR
TP #1	5/93	Weston	12	Test pit	mg/kg	4	31,900	NR
TP #2	5/93	Weston	12	Test pit	mg/kg	1.5	1,740	NR
TP #3	5/93	Weston	12	Test pit	mg/kg	2	26,300	NR
TP #4	5/93	Weston	12	Test pit	mg/kg	2	34,900	NR
TP #5	5/93	Weston	12	Test pit	mg/kg	6	33,100	NR
TP #6	5/93	Weston	12	Test pit	mg/kg	2.5	30,400	NR
TP #7	5/93	Weston	12	Test pit	mg/kg	2	32,100	NR
TP #8	5/93	Weston	12	Test pit	mg/kg	3	32,600	NR
001	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	722	<2.7
002	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	17.5	<3
003	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	1,990	270
004	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	21.4	<3
005	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	733	8.2
006	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	2,000	16
007	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	2,520	13
008	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	1,490	15
009	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	2,540	110
010	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	529	8.6
011	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	579	<30
012	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	129	<3.6
013	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	1,100	7.3
014	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	2,240	13
015	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	520	3.4
016	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	769	12
017	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	511	3.8
018	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	224	3
031	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	9,900	<0.14
032	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	5,330	0.65
033	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	9,900	244

TA J - 02  
SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION  
PREVIOUS INVESTIGATIONS  
TOTAL AND HEXAVALENT CHROMIUM  
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	Depth (ft bgs)	Total Cr	Cr(VI)
034	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	18,000	<0.11
035	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	11,000	0.39
036	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	6,460	<0.26
037	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	5,120	54
038	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	18,800	<0.23
039	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	11,500	195
040	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	7,050	<0.24
041	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	9,390	0.15
042	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	11,900	<0.12
043	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	8,570	<0.15
044	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	579	<0.26
045	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	95.7	<0.13
046	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	59.7	<0.14
047	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	142	<0.14
048	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	188	<0.28
001	8/91	French & Parrello	8	Sweep Sample	mg/kg	NA	623	<2.7
002	8/91	French & Parrello	8	Sweep Sample	mg/kg	NA	322	33
003	8/91	French & Parrello	8	Sweep Sample	mg/kg	NA	423	12
TPS-A1-1	1/00	ES	20	Sediment	mg/kg	1	3,207	ND
TPS-A1-5	1/00	ES	20	Sediment	mg/kg	5	9.5	ND
TPS-A1-10	1/00	ES	20	Sediment	mg/kg	10	24.7	ND
TPS-A2-1	1/00	ES	20	Sediment	mg/kg	1	3,197	ND
TPS-A2-5	1/00	ES	20	Sediment	mg/kg	5	930	73.1
TPS-A2-10	1/00	ES	20	Sediment	mg/kg	10	38.7	3.81
TPS-A3-1	1/00	ES	20	Sediment	mg/kg	1	1,280	ND
TPS-A3-5	1/00	ES	20	Sediment	mg/kg	5	257	4.29
TPS-A3-10	1/00	ES	20	Sediment	mg/kg	10	14.3	ND
TPS-B1-1	1/00	ES	20	Sediment	mg/kg	1	1,079	ND
TPS-B1-5	1/00	ES	20	Sediment	mg/kg	5	143	ND
TPS-B1-10	1/00	ES	20	Sediment	mg/kg	10	6.59	ND
TPS-B2-1	1/00	ES	20	Sediment	mg/kg	1	5,240	ND
TPS-B2-5	1/00	ES	20	Sediment	mg/kg	5	34.2	ND

## **1990-1993 Remedial Investigation**

Table 5-4

Summary of Test Pit Analytical Data  
Chromium  
SCCC, Kearny, NJ

Test Pit Sample Location	Lab ID Number	Depth of Sample (ft)	Chromium (mg/kg)	Detection Limit
TP #1	HA3643	4.0	31900	1.9
TP #2	HA3632	1.5	1740	1.3
TP #3	HA3639	2.0	26300	1.6
TP #4	HA3636	2.0	34900	1.6
TP #5	HA3637	6.0	33100	1.6
TP #6	HA3641	2.5	30400	1.7
TP #7	HA3640	2.0	32100	1.5
TP #8	HA3679	3.0	32600	1.9



**TABLE 5-5**  
**SUMMARY OF SOIL ANALYTICAL DATA**  
**VOLATILE AND SEMIVOLATILE ORGANICS**  
**SCCC, KEARNY, NJ**

LAB NUMBER SAMPLE NUMBER	HIA3566 TSS-1		HIA3565 TSS-2		HIA3564 TSS-3		HIA3572 TSS-4		HIA3570 TSS-5		HIA3571 TSS-6		HIA3573 TSS-7	
	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.
<b>VOC Compound (ug/kg)</b>														
Benzene	ND	27000	ND	6400	ND	7.20	ND	3300	BMDL	110.0	ND	76.0	ND	7.50
Chlorobenzene	99600	38000	ND	8700	BMDL	9.80	5940	4500	300.0	150.0	ND	100.0	BMDL	10.00
Methylene Chloride	ND	18000	5690	4100	ND	4.60	ND	2100	114.0	72.0	70.8	48.0	6.57	4.70
1,2-Trans-dichloroethylene	ND	10000	ND	2300	ND	2.60	ND	1200	76.5	41.0	ND	28.0	20.50	2.70
Tetrachloroethylene	ND	26000	ND	5900	BMDL	6.70	ND	3100	2310.0	110.0	BMDL	71.0	12.50	6.90
Trichloroethylene	ND	12000	ND	2800	ND	3.10	ND	1400	866.0	49.0	ND	33.0	29.20	3.20
<b>BNA Compound (ug/kg)</b>														
Acenaphthene	92000	12000	219000	2700	ND	3100	BMDL	2900	11800	4900	ND	3300	ND	3200
Acenaphthylene	24100	22000	BMDL	5100	ND	5700	ND	5300	ND	9000	ND	6000	ND	5900
Anthracene	46200	12000	7290	2700	ND	3100	ND	2900	ND	4900	ND	3300	ND	3200
Benzo(a)anthracene	BMDL	49000	BMDL	11000	BMDL	13000	BMDL	12000	BMDL	20000	BMDL	13000	ND	13000
Benzo(a)pyrene	ND	16000	3840	3600	34100	4100	6580	3800	ND	6400	4910	4300	4950	4200
Benzo(b)fluoranthene	ND	30000	BMDL	6900	65800	7900	16700	7200	14000	12000	11600	8200	8700	8100
Benzo(ghi)perylene	ND	26000	BMDL	5900	31400	6700	7940	6200	BMDL	11000	9050	7000	10500	6900
bis(2-Ethylhexyl)phthalate	ND	63000	ND	14000	ND	16000	ND	15000	30000	26000	34500	17000	44500	17000
Chrysene	41900	16000	7420	3600	14600	4100	12000	3800	12500	6400	6670	4300	4830	4200
Dibenzo(a,h)anthracene	ND	16000	ND	3600	7280	4100	ND	3800	ND	6400	ND	4300	ND	4200
1,2-Dichlorobenzene	3850000	12000	4680000	2700	12100	3100	34400	2900	522000	4900	10800	3300	3780	3200
1,3-Dichlorobenzene	1210000	12000	738000	2700	14500	3100	9590	2900	394000	4900	9500	3300	6400	3200
1,4-Dichlorobenzene	2230000	27000	4840000	6400	54600	7200	15000	6600	52200	11000	15700	7600	BMDL	7400
Di-n-butyl phthalate	ND	63000	ND	14000	ND	16000	ND	15000	ND	26000	ND	17000	ND	17000
Fluoranthene	121000	14000	12300	3200	7280	3600	8990	3300	12300	5600	5330	3800	BMDL	3700
Fluorene	213000	12000	45600	2700	ND	3100	ND	2900	BMDL	4900	ND	3300	ND	3200
Hexachlorobenzene	45000	12000	137000	2700	ND	3100	30400	2900	359000	4900	56900	3300	21100	3200
Hexachlorobutadiene	ND	5600	8520	1300	ND	1500	ND	1400	ND	2300	ND	1500	ND	1500
Indeno(1,2,3-c,d)pyrene	ND	23000	BMDL	5400	35900	6100	10500	5600	BMDL	9500	10100	6400	11300	6300
Naphthalene	2370000000	10000	167000	2300	191000	2600	5020	2400	ND	4100	51800	2700	7310	2700
Phenanthrene	428000	34000	35300	7800	BMDL	8900	10900	8100	19300	14000	BMDL	9300	ND	9100
Pyrene	70500	12000	8020	2700	6690	3100	5800	2900	7690	4900	4310	3300	BMDL	3200
1,2,4-Trichlorobenzene	75000000	12000	3040000	2700	6360	3100	14100000	2900	68200000	4900	30100	3300	25400	3200

CONC. – Concentration of Compound  
D.L. – Detection Limit  
ND – Not Detected  
BMDL – Present below detection limit  
B – Blank sample

TABLE 5-5 (Continued)  
SUMMARY OF SOIL ANALYTICAL DATA  
VOLATILE AND SEMIVOLATILE ORGANICS  
SCCC, KEARNY, NJ

LAB NUMBER SAMPLE NUMBER	IIA3574 TSS-8		IIA3569 TSS-9		IIA3568 TSS-9D		IIA3567 TSS-10	
	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.
<b>VOC Compound (ug/kg)</b>								
Benzene	ND	6.70	ND	8100	ND	6600	BMDL	6.90
Chlorobenzene	ND	9.10	33500	11000	68400	9000	89.10	9.40
Methylene Chloride	ND	4.20	7020	5200	5980	4200	ND	4.40
1,2-Trans-dichloroethylene	ND	2.40	ND	3000	ND	2400	ND	2.50
Tetrachloroethylene	ND	6.20	ND	7600	BMDL	6100	9.91	6.40
Trichloroethylene	ND	2.90	ND	3500	ND	2800	ND	3.00
<b>BNA Compound (ug/kg)</b>								
Acenaphthene	ND	2900	ND	3500	BMDL	2800	3810	3000
Acenaphthylene	ND	5300	ND	6500	ND	5200	ND	5500
Anthracene	ND	2900	3830	3500	4270	2800	8050	3000
Benzo(a)anthracene	ND	12000	BMDL	14000	BMDL	12000	BMDL	12000
Benzo(a)pyrene	BMDL	3800	BMDL	4600	ND	3700	ND	3900
Benzo(b)fluoranthene	BMDL	7200	33100	8900	ND	7100	ND	7500
Benzo(ghi)perylene	BMDL	6200	9000	7600	6810	6100	ND	6400
bis(2-Ethylhexyl)phthalate	ND	15000	ND	19000	ND	15000	ND	16000
Chrysene	ND	3800	21500	4600	17200	3700	10900	3900
Dibenzo(a,h)anthracene	ND	3800	ND	4600	ND	3700	ND	3900
1,2-Dichlorobenzene	ND	2900	4340000	3500	6470000	2800	6530	3000
1,3-Dichlorobenzene	ND	2900	1270000	3500	1550000	2800	66200	3000
1,4-Dichlorobenzene	ND	6600	876000	8100	1200000	6500	41700	6900
Di-n-butyl phthalate	ND	15000	ND	19000	ND	15000	ND	16000
Fluoranthene	BMDL	3300	33800	4100	23400	3300	18900	3400
Fluorene	ND	2900	ND	3500	BMDL	2800	24400	3000
Hexachlorobenzene	BMDL	2900	34800	3500	23800	2800	ND	3000
Hexachlorobutadiene	ND	1400	ND	1700	ND	1300	ND	1400
Indeno(1,2,3-c,d)pyrene	BMDL	5600	11100	6900	7660	5500	ND	5800
Naphthalene	16700	2400	ND	3000	ND	2400	448000	2500
Phenanthrene	BMDL	8100	59700	10000	59900	8000	179000	8400
Pyrene	BMDL	2900	17100	3500	11900	2800	21500	3000
1,2,4-Trichlorobenzene	28300	2900	100000000	3500	200000000	2800	62800	3000

CONC. – Concentration of Compound

D.L. – Detection Limit

ND – Not Detected

BMDL – Present below detection limit

B – Blank sample

**TABLE 5-6**  
**SUMMARY OF ANALYTICAL DATA**  
**SOIL BORINGS**  
**VOLATILE AND SEMIVOLATILE ORGANICS**  
**SCCC, KILARNY, NJ**

LAB NUMBER SAMPLE NUMBER	HA3563 MW-2L		CB2169 SB-2A		CB2170 SB-2B		CB2177 SB-3A		CB2179 SB-3B		CB2176 SB-4A		CB2178 SB-4B	
	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.
<b>VOC's (ug/kg)</b>														
Chloromethane	ND	1100	ND	13	ND	71000	ND	1400	350 J	1500	180	1500	ND	2000
Acetone	NA	NA	16	13	4300 J	71000	ND	1400	ND	1500	350 J	1500	410	2000
2-Butanone	NA	NA	ND	13	ND	71000	450 J	1400	170 J	1500	560 J	1500	ND	2000
1,1,1-Trichloroethane	ND	400	ND	13	ND	71000	360 J	1400	ND	1500	500 J	1500	460	2000
Carbon Tetrachloride	ND	300	ND	13	ND	71000	ND	1400	ND	1500	89 J	1500	ND	2000
Benzene	ND	470	ND	13	48000 J	71000	320 J	1400	110 J	1500	150 J	1500	600	2000
1,2-Dichloroethene	NA	NA	ND	13	ND	71000	ND	1400	790 J	1500	ND	1500	ND	2000
Chlorobenzene	BMDL	640	ND	13	220000	71000	15000	1400	91 J	1500	5100	1500	27000	2000
Toluene	NA	640	1 JB	13	960 J	71000	160 J	1400	ND	1500	210 J	1500	160	2000
Xylene	NA	NA	ND	13	ND	71000	ND	1400	ND	1500	150 J	1500	ND	2000
Tetrachloroethene	ND	440	3 J	13	ND	71000	ND	1400	16000	1500	150 J	1500	ND	2000
Styrene	NA	NA	ND	13	ND	71000	ND	1400	ND	1500	120 J	1500	ND	2000
<b>BNA's (ug/kg)</b>														
1,2-Dichlorobenzene	1140	460	6800 J	13000	9200000	1200000	400000	12000	ND	200000	98000 J	12000	ND	13000
1,3-Dichlorobenzene	833	460	3500 J	13000	1300000	1200000	410000	12000	ND	200000	12000 J	12000	ND	13000
1,4-Dichlorobenzene	1290	1100	3400 J	13000	1300000	1200000	430000	12000	ND	200000	7000 J	12000	ND	13000
Naphthalene	3220	390	5300 J	13000	ND	1200000	ND	12000	ND	200000	ND	12000	ND	13000
2 Methyl Naphthalene	NA	NA	6600 J	13000	ND	1200000	ND	12000	ND	200000	ND	12000	ND	13000
1,2,4-Trichlorobenzene	ND	460	6000 J	13000	240000 J	1200000	34000	12000	ND	200000	ND	12000	ND	13000
Acenaphthene	1100	460	25000	13000	ND	1200000	ND	12000	ND	200000	ND	12000	ND	13000
2,4, Dimethyl Phenol	ND	660	ND	13000	ND	1200000	ND	12000	ND	200000	ND	12000	ND	13000
Dibenzofuran	NA	NA	15000	13000	ND	1200000	ND	12000	ND	200000	ND	12000	ND	13000
Fluorene	1360	460	33000	13000	ND	1200000	ND	12000	ND	200000	ND	12000	ND	13000
Phenanthrene	3660	1300	200000	13000	ND	1200000	ND	12000	ND	200000	ND	12000	ND	13000
Anthracene	587	460	90000	13000	ND	1200000	ND	12000	ND	200000	ND	12000	ND	13000
Carbazole	NA	NA	10000 J	13000	ND	1200000	ND	12000	ND	200000	ND	12000	ND	13000
Fluoranthene	3140	530	200000	13000	ND	1200000	ND	12000	ND	200000	ND	12000	ND	13000
Pyrene	1890	460	190000	13000	ND	1200000	ND	12000	ND	200000	ND	12000	ND	13000
Benzo(a) anthracene	BMDL	1900	87000	13000	ND	1200000	ND	12000	ND	200000	ND	12000	ND	13000
Chrysene	629	610	79000	13000	ND	1200000	ND	12000	ND	200000	ND	12000	ND	13000
Benzo(b) Fluoranthene	1800	1200	58000	13000	ND	1200000	ND	12000	ND	200000	ND	12000	ND	13000
Benzo(a)Pyrene	BMDL	610	82000	13000	ND	1200000	ND	12000	ND	200000	ND	12000	ND	13000
Indeno(1,2,3-cd) Pyrene	ND	900	54000	13000	ND	1200000	ND	12000	ND	200000	ND	12000	ND	13000
Benzo(g,h,i) Perylene	ND	1000	53000	13000	ND	1200000	ND	12000	ND	200000	ND	12000	ND	13000
bis(2-Ethylhexyl)phthalate	9920	2400	ND	13000	ND	1200000	ND	12000	ND	200000	ND	12000	ND	13000
Di-n-butyl phthalate	3060	2400	ND	13000	ND	1200000	ND	12000	ND	200000	ND	12000	ND	13000
<b>Pest/PCB (ug/kg)<sup>(1)</sup>:</b>														
Arochlor 1248	NA	NA	ND	1300	ND	39	ND	38	ND	42	ND	41	66	41
Arochlor 1254	NA	NA	ND	1300	ND	39	ND	38	ND	42	ND	41	ND	41
Arochlor 1260	NA	NA	ND	1300	ND	39	ND	38	900 J	42	61	41	ND	41

CONC. - Concentration of compound

D.L. - Detection Limit

ND - Not detected

BMDL - Present below method detection limit, estimated concentration not reported by laboratory

<sup>(1)</sup> Laboratory method may detect false positives due to interference of elevated concentrations of chlorinated solvent compounds.

**TABLE 5-6 (Continued)**  
**SUMMARY OF SOIL ANALYTICAL DATA**  
**METALS**  
**SCCC, KEARNY, NJ**

LAB NUMBER SAMPLE NUMBER	IIA3563 MW-2L		CB2169 SB-2A		CB-2170 SB-2B		CB2177 SB-3A		CB2179 SB-3B		CB2176 SB-4A		CB2178 SB-4B	
	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.
<b>Metal (mg/L)</b>														
Antimony	BMDL	13	ND	24	ND	24	ND	24	ND	24	47.5	24	20.1	24
Arsenic	BMDL	2.1	4.21	4	BMDL	4	2.53	4	2.71	4	41.9	4	13.2	4
Beryllium	BMDL	0.21	BMDL	0.4	BMDL	0.4	BMDL	0.4	BMDL	0.4	BMDL	0.4	BMDL	0.4
Cadmium	0.93	0.43	BMDL	0.8	ND	0.8	BMDL	0.8	BMDL	0.8	4.16	0.8	1.9	0.8
Chromium	593	2.1	36.7	4	4.45	4	685	4	0.39	4	428	4	130	4
Copper	26	2.1	23.6	4	BMDL	4	109	4	23.2	4	335	4	124	4
Lead	640	16	270	30	4.82	30	53	30	19.9	30	647	30	241	30
Mercury	BMDL	0.17	0.55	0.32	ND	0.32	BMDL	0.32	BMDL	0.32	ND	0.32	BMDL	0.32
Nickel	45	4.3	9.4	8.1	BMDL	8.1	14.6	8.1	9.73	8.1	51.8	8.1	25.5	8.1
Selenium	NA	NA	BMDL	2	ND	2	ND	2	ND	2	BMDL	2	ND	2
Silver	BMDL	2.1	ND	4	ND	4	ND	4	ND	4	BMDL	4	ND	4
Thallium	NA	NA	ND	4	ND	4	ND	4	ND	4	ND	4	ND	4
Zinc	55	4.3	99.3	8.1	14.2	8.1	90.6	8.1	42.3	8.1	3710	8.1	1520	8.1
Cyanide	1.2	1.1	ND	0.6	ND	0.6	2.1	0.6	ND	0.6	ND	0.6	ND	0.6

CONC. – Concentration of compound

D.L. – Detection Limit

ND – Not detected

NA – Not analyzed

BMDL – Present below method detection limit, estimated concentration not reported by laboratory

## **1996-1997 Focused Remedial Investigation**

Table J-3  
Summary of FRI Soil Sample Results  
Standard Chlorine Chemical Company  
Kearny, New Jersey Facility

Sample ID	NJDEP Soil Cleanup Criteria		SB03	SB04	SB09	SB09	SB14
Sample Depth (ft)			14.5-15	15-15.5	1.5-2	15-15.5	18.5-19
Lab ID#	Residential	NonRes	BR1903	BR1919	BR1920	BR1921	BR1911
Sample Date	Direct	Direct	8/5/96	8/12/96	8/12/96	8/12/96	8/7/96
Sample Time	Contact	Contact	1735	1145	1335	1450	1000
Matrix			Soil	Soil	Soil	Soil	Soil
Units	µg/kg		µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Parameter							
VOC's (µg/kg)							
1,2,3-Trichlorobenzene	NA	NA	1,770,000	1,000,000	32.6	345,000	91.9
1,2,4-Trichlorobenzene	68,000	1,200,000	<b>6,540,000</b>	<b>1,870,000</b>	20.3	1,180,000	350
1,2,4-Trimethylbenzene	NA	NA					2.15 BMDL
1,2-Dichlorobenzene	5,100,000	10,000,000	1,080,000	1,310,000	5.98 BMDL	506,000	70.2
1,3-Dichlorobenzene	5,100,000	10,000,000	1,700,000	433,000 BMDL	3.29 BMDL	210,000	50.9
1,4-Dichlorobenzene	570,000	10,000,000	1,630,000	677,000	5.59 BMDL	257,000	53.5
Acetone	1,000,000	1,000,000					135
Butylbenzene	NA	NA		57,800 BMDL			
Chlorobenzene	37,000	680,000				42,600 BMDL	3.49 BMDL
Trichloroethylene	23,000	54,000			5.6 BMDL		
SVOC's (µg/kg)							
Naphthalene	230,000	4,200,000	1,010,000	2,400,000	191	181,000	57.2
Tetrachloroethylene	4,000	6,000				<b>56,900 BMDL</b>	

Sample ID	NJDEP Soil Cleanup Criteria		SB07	SB10R	SB01
Sample Depth (ft)			15.5-16	16-16.5	15.5-16
Lab ID#	Residential	NonRes	BR1927	BR1930	BR1931
Sample Date	Direct	Direct	08/16/96	08/16/96	08/16/96
Sample Time	Contact	Contact			
Matrix			Soil	Soil	Soil
Units	µg/kg		µg/kg	µg/kg	µg/kg
Parameter					
VOC's (µg/kg)					
1,2,3-Trichlorobenzene	NA	NA		2,140,000	
1,2,4-Trichlorobenzene	68,000	1,200,000		<b>2,290,000</b>	2 BMDL
1,2,4-Trimethylbenzene	NA	NA	65,500	60,800 BMDL	
1,2-Dichlorobenzene	5,100,000	10,000,000		2,320,000	115
1,3,5-Trimethylbenzene	NA	NA	23,900 BMDL		
1,3-Dichlorobenzene	5,100,000	10,000,000		557,000	43
1,4-Dichlorobenzene	570,000	10,000,000		1,160,000	89
m+p-Xylenes	410,000	1,000,000	44,300 BMDL		
o-Xylene	410,000	1,000,000	18,300 BMDL		
SVOC's (µg/kg)					
Naphthalene	230,000	4,200,000	1,820,000	5,750,000	26

Notes:

Values that are shaded are above the NJDEP Soil Cleanup Criteria for Residential Direct Contact limitations.

Values that are in bold italics, shaded and boxed are above the NJDEP Soil Cleanup Criteria for Industrial Direct Contact Limitations.

BMDL = Concentration detected below method detection limit.

NA = No standard available.

## **1997-1999 Supplemental Remedial Investigation**

TABLE 3-2  
SOIL ANALYTICAL RESULTS  
SEMI - VOLATILE ORGANIC COMPOUNDS  
STANDARD CHLORINE CHEMICAL COMPANY

CONSTITUENT: (Units in ug/kg)	NEW JERSEY IMPACT TO GROUNDWATER SOIL CLEANUP CRITERIA	NEW JERSEY CLASS II-A NON-RESIDENTIAL SOIL CLEANUP CRITERIA	NEW JERSEY CLASS II-A RESIDENTIAL SOIL CLEANUP CRITERIA	SITE: SAMPLE ID: DATE DEPTH (ft):	SC-MW-16L SCMW150002 1/13/99 0-2	SC-MW-16L SCMW160810 1/13/99 8-12	SC-MW-17L SCMW170002 1/13/99 0-2	SC-MW-17L SCMW171012 1/13/99 10-12	SC-SB15 SCSB150002 1/14/99 0-2	SC-SB15 SCSB150002DL 1/14/99 0-2 DILUTED	SC-SB15 SCSB150810 1/14/99 8-10	SC-SB15 SCSB151518 1/14/99 16-18	SC-SB16 SCSB160002 1/14/99 0-2	SC-SB16 SCSB161012 1/14/99 10-12	SC-SB16 SCSB161618 1/14/99 16-18
Phenol	50000	10000000	10000000		< 380	< 440	500	< 730	< 410	< 16000	< 1300	< 500	< 1600	< 460	< 410
Bis(2-chloroethyl)ether	10000	3000	660		< 120	< 140	< 130	< 220	< 120	< 5000	< 400	< 150	< 470	< 140	< 120
2-Chlorophenol	10000	5200000	280000		< 380	< 440	< 430	< 730	< 410	< 16000	< 1300	< 500	< 1600	< 460	< 410
1,3-Dichlorobenzene	100000	10000000	5100000		75 J	540	52 J	94 J	< 120	< 5000	< 400	< 150	< 470	< 140	< 120
1,4-Dichlorobenzene	100000	10000000	570000		< 120	2000	130 J	200 J	< 120	< 5000	< 400	< 150	< 470	< 140	< 120
1,2-Dichlorobenzene	50000	10000000	5100000		76 J	190	< 130	< 220	< 120	< 5000	< 400	< 150	< 470	< 140	< 120
2-Methylphenol		10000000	2800000		< 380	< 440	230 J	< 730	< 410	< 16000	< 1300	< 500	< 1600	< 460	< 410
Propane, 2,2'-oxybis[1-chloro-					< 120	< 140	< 130	< 220	< 120	< 5000	< 400	< 150	< 470	< 140	< 120
4-Methylphenol		10000000	2800000		< 380	< 440	< 430	< 730	< 410	< 16000	< 1300	< 500	320 J	< 460	< 410
N-Nitrosodipropylamine	10000	660	660		< 120	< 140	< 130	< 220	< 120	< 5000	< 400	< 150	< 470	< 140	< 120
Hexachloroethane	100000	100000	6000		< 120	< 140	< 130	< 220	< 120	< 5000	< 400	< 150	< 470	< 140	< 120
Nitrobenzene	50000	50000	28000		< 120	< 140	< 130	< 220	< 120	< 5000	< 400	< 150	< 470	< 140	< 120
Isophorone	50000	10000000	1100000		< 120	< 140	< 130	< 220	< 120	< 5000	< 400	< 150	< 470	< 140	< 120
2-Nitrophenol					< 380	< 440	< 430	< 730	< 410	< 16000	< 1300	< 500	< 1600	< 460	< 410
2,4-Dimethylphenol	10000	10000000	1100000		< 380	< 440	220 J	< 730	< 410	< 16000	< 1300	< 500	360 J	< 460	< 410
Bis(2-chloroethoxy)methane					< 120	< 140	< 130	< 220	< 120	< 5000	< 400	< 150	< 470	< 140	< 120
2,4-Dichlorophenol	10000	3100000	170000		< 380	< 440	< 430	< 730	< 410	< 16000	< 1300	< 500	< 1600	< 460	< 410
1,2,4-Trichlorobenzene	100000	1200000	68000		< 120	< 140	< 130	< 220	< 120	< 5000	< 400	< 150	< 470	< 140	< 120
Naphthalene	100000	4200000	230000		< 120	< 140	40 J	92 J	210	< 5000	< 400	70 J	240 J	< 140	< 120
4-Chloroaniline		4200000	230000		< 120	< 140	< 130	< 220	< 120	< 5000	< 400	< 150	< 470	< 140	< 120
Hexachlorobutadiene	100000	21000	1000		< 120	< 140	< 130	< 220	< 120	< 5000	< 400	< 150	< 470	< 140	< 120
4-Chloro-3-methylphenol	100000	10000000	10000000		< 120	< 140	< 130	< 220	< 120	< 5000	< 400	< 150	< 470	< 140	< 120
2-Methylnaphthalene					< 120	< 140	< 130	< 220	110 J	< 5000	< 400	< 150	< 470	< 140	< 120
Hexachlorocyclopentadiene	100000	7300000	400000		< 120	< 140	< 130	< 220	< 120	< 5000	< 400	< 150	< 470	< 140	< 120
2,4,6-Trichlorophenol	10000	270000	62000		< 380	< 440	< 430	< 730	< 410	< 16000	< 1300	< 500	< 1600	< 460	< 410
2,4,5-Trichlorophenol	50000	10000000	5600000		< 2000	< 2300	< 2200	< 3800	< 2100	< 84000	< 6800	< 2600	< 8100	< 2300	< 2100
2-Chloronaphthalene					< 120	< 140	< 130	< 220	< 120	< 5000	< 400	< 150	< 470	< 140	< 120
2-Nitroaniline					< 2000	< 2300	< 2200	< 3800	< 2100	< 84000	< 6800	< 2600	< 8100	< 2300	< 2100
Dimethylphthalate	50000	10000000	10000000		< 120	< 140	< 130	< 220	< 120	< 5000	< 400	< 150	620	< 140	< 120
Acenaphthylene					< 120 J	< 140	< 130	(69)	130	< 5000	< 400	< 150	< 470	< 140	< 120
2,6-Dinitrotoluene					< 120	< 140	< 130	< 220	< 120	< 5000	< 400	< 150	< 470	< 140	< 120
3-Nitroaniline					< 2000	< 2300	< 2200	< 3800	< 2100	< 84000	< 6800	< 2600	< 8100	< 2300	< 2100
Acenaphthene	100000	10000000	3400000		< 120	< 140	< 130	520	240	< 5000	< 400	< 150	< 470	< 140	< 120
2,4-Dinitrophenol	10000	2100000	110000		< 2000	< 2300	< 2200	< 3800	< 2100	< 84000	< 6800	< 2600	< 8100	< 2300	< 2100
4-Nitrophenol					< 2000	< 2300	< 2200	< 3800	< 2100	< 84000	< 6800	< 2600	< 8100	< 2300	< 2100
Dibenzofuran					< 120	< 140	< 130	67 J	160	< 5000	< 400	< 150	< 470	< 140	< 120
2,4-Dinitrotoluene					< 120	< 140	< 130	< 220	< 120	< 5000	< 400	< 150	< 470	< 140	< 120
Diethylphthalate	50000	10000000	10000000		< 120	< 140	< 130	< 220	< 120	< 5000	< 400	< 150	< 470	< 140	< 120
4-Chlorophenyl phenyl ether					< 120	< 140	< 130	< 220	< 120	< 5000	< 400	< 150	< 470	< 140	< 120
Fluorene	100000	10000000	2300000		< 120	< 140	< 130	170 J	240	< 5000	< 400	< 150	< 470	< 140	< 120
4-Nitroaniline					< 2000	< 2300	< 2200	< 3800	< 2100	< 84000	< 6800	< 2600	< 8100	< 2300	< 2100
4,6-Dinitro-o-cresol					< 2000	< 2300	< 2200	< 3800	< 2100	< 84000	< 6800	< 2600	< 8100	< 2300	< 2100
N-Nitrosodiphenylamine	100000	600000	140000		< 120	< 140	150	< 220	< 120	< 5000	< 400	< 150	< 470	< 140	< 120
4-Bromophenyl phenyl ether					< 120	< 140	< 130	< 220	< 120	< 5000	< 400	< 150	< 470	< 140	< 120
Hexachlorobenzene	100000	2000	660		< 120	< 140	< 130	< 220	< 120	< 5000	< 400	< 150	< 470	< 140	< 120
Pentachlorophenol	100000	24000	6000		< 2000	< 2300	< 2200	< 3800	< 2100	< 84000	< 6800	< 2600	< 8100	< 2300	< 2100
Phenanthrene					210	< 140	170	820	2000	2400	JD	230 J	< 470	< 140	< 120
Anthracene	100000	10000000	10000000		91 J	< 140	58 J	280	570	< 5000	< 400	< 150	< 470	< 140	< 120
Carbazole					39 J	< 140	< 130	100 J	360	< 5000	< 400	< 150	< 470	< 140	< 120
Di-n-butyl phthalate	100000	10000000	5700000		< 120	< 140	< 130	< 220	< 120	< 5000	< 400	< 150	< 470	< 140	< 120
Fluoranthene	100000	10000000	2300000		460	50 J	380	1200	3100	3500	JD	400	< 150	< 470	< 120
Pyrene	100000	10000000	1700000		410	44 J	340	1200	6900	2500	JD	320 J	< 150	< 470	< 120
Butyl benzyl phthalate	100000	10000000	1100000		< 120	< 140	< 130	< 220	< 120	< 5000	< 400	< 150	< 470	< 140	< 120
3,3-Dichlorobenzidine	100000	6000	2000		< 120	< 140	< 130	< 220	< 120	< 5000	< 400	< 150	< 470	< 140	< 120
Benzo(a)anthracene	500000	4000	900		280	< 140	240	470	[1500]	[1800]	JD	200 J	< 150	< 470	< 120
Chrysene	500000	40000	9000		280	< 140	260	480	6400	E	1600	JD	200 J	< 150	< 120
Bis(2-ethylhexyl)phthalate (BEHP)	100000	210000	49000		100 J	< 140	75 J	< 220	[120000]	E	[220000]	JD	290 J	71 J	< 120
Di-n-octyl phthalate	100000	10000000	1100000		< 120	< 140	< 130	< 220	[190000]	E	[190000]	D	< 400	< 150	< 120
Benzo(b)fluoranthene	50000	4000	900		450	41 J	480	680	[2200]	[2100]	JD	300 J	< 150	< 470	< 120
Benzo(k)fluoranthene	500000	4000	900		190	< 140	170	95 J	[2200]	< 5000	< 400	< 150	< 470	< 140	< 120
Benzo(a)pyrene	100000	660	660		360	< 140	380	420	< 120	< 5000	210 J	< 150	< 470	< 140	< 120
Indeno(1,2,3-cd)pyrene	500000	4000	900		190	< 140	< 130	< 220	880	< 5000	< 400	< 150	< 470	< 140	< 120
Dibenzo(a,h)anthracene	100000	660	660		< 120	< 140	< 130	< 220	450	< 5000	< 400	< 150	< 470	< 140	< 120
Benzo(ghi)perylene					48 J	< 140	210	160 J	200	< 5000	< 400	< 150	< 470	< 140	< 120

[ ] - Indicates sample concentration greater than New Jersey Residential Soil Cleanup Criteria.  
J - Estimated concentration less than the method detection limit.  
D - Sample concentration determined by analysis of diluted sample.  
E - Estimated minimum value, concentration greater than instrument calibration range.



### **A.3 Groundwater Data**

## 1983-1984 Hydrogeologic Investigation

Table 1-2

**Summary of Groundwater Results (1983)**  
**SCCC, Kearny, NJ**

Parameters	1S	1D	2S	2D	3S	3D	4S	4D	5S	5D
pH	8.4	6.3	9.3	5.6	8.8	5.3	11.4	4.8	11.4	2.0
Conductivity (umhos)	1050	2150	5000	5000	2450	2400	5000	5000	5000	5000
Total Chromium	<0.05	<0.05	7.7	0.3	0.29	0.06	101.7	0.44	NA	44.3
Hexavalent Chromium	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	97.0	<0.1	NA	<0.1
Benzene	ND	125	ND	1000	65	670	ND	220	190	50
Chlorobenzene	ND	1850	1500	660	55	ND	93000	13900	450	ND
1,1,2-trichloroethane	ND	ND	ND	ND	ND	ND	ND	30	ND	ND
1,1-dichloroethylene	ND	ND	ND	ND	ND	ND	ND	20	ND	ND
trans-1,2-dichloroethylene	ND	ND	ND	30	ND	ND	ND	ND	ND	ND
Ethylbenzene	ND	ND	ND	300	ND	310	ND	ND	ND	ND
Tetrachloroethylene	ND	ND	ND	ND	25	ND	ND	5350	ND	ND
Toluene	ND	ND	ND	435	ND	640	ND	ND	ND	ND
Trichloroethylene	ND	ND	ND	20	35	ND	ND	13960	ND	ND
Total Xylenes	ND	ND	ND	745	55	1550	ND	ND	ND	ND
Acenaphthene	ND	ND	ND	ND	540	28	10	ND	ND	4300
Anthracene	ND	ND	ND	ND	630	64	10	ND	ND	120
Bis(2-ethylhexyl)phthalate	ND	ND	ND	ND	ND	ND	22	31	12	ND
1,2-dichlorobenzene	ND	1500	ND	2700	ND	ND	ND	4900	ND	ND
1,3-dichlorobenzene	ND	3100	ND	1400	ND	ND	ND	ND	ND	ND
1,4-dichlorobenzene	ND	4100	ND	3700	ND	ND	10	ND	ND	ND
Dimethyl phthalate	ND	ND	ND	ND	10	ND	ND	ND	ND	ND
Di-n-butyl phthalate	ND	10	ND	19	ND	ND	ND	32	10	ND
Fluoranthene	ND	ND	ND	ND	86	ND	ND	ND	ND	ND
Flourene	ND	ND	ND	ND	570	ND	ND	ND	ND	ND
Naphthalene	ND	10	ND	ND	ND	53	510	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	170	ND	ND	ND	ND	ND
1,2,4-trichlorobenzene	ND	10	ND	ND	ND	ND	ND	ND	10	ND
1,2-diphenyl hydrazene	ND	ND	ND	ND	ND	ND	ND	ND	ND	37
Detection Limits*	10/10	10/10	10/10	5/10	10/10	10/10	250/10	10/10	5/10	5/10

NA = Not Analyzed

ND = Not Detected

\* = First number is the detection limit for volatile organics, the second number is the detection limit for base-neutrals. Detection limits will vary with degree of contamination.

Note: All concentrations in parts per billion (ppb), except where noted.

## **1990-1993 Remedial Investigation**

**TABIE 5-11**  
**SUMMARY OF PHASE I GROUNDWATER ANALYTICAL DATA**  
**VOLATILES AND SEMIVOLATILES**  
**SCCC, KIRBY, NJ**

LAB NUMBER SAMPLE NUMBER	11A3935 MW-11. CONC. D.L.		11A3936 MW-11DUP CONC. D.L.		11A3941 MW-2L CONC. D.L.		11A3937 MW-3L CONC. D.L.		11A3941 MW-4L CONC. D.L.		11A3943 MW-5L CONC. D.L.		11A3940 MW-6L CONC. D.L.		11A3942 MW-7L CONC. D.L.		11A3945 MW-8L CONC. D.L.		11A3938 MW-9L CONC. D.L.	
VOC's (ug/L)																				
Methyl chloride	ND	10.0	ND	10.0	ND	250	ND	10.0	ND	1000	ND	250	ND	100	ND	250	ND	500	BMDL	20.0
Dichlorodifluoromethane	ND	10.0	ND	10.0	ND	250	10.6	10.0	ND	1000	ND	250	ND	100	ND	250	ND	500	ND	20.0
Vinyl chloride	ND	10.0	ND	10.0	ND	250	ND	10.0	ND	1000	ND	250	ND	100	ND	250	669	500	ND	20.0
Methylene chloride	ND	2.8	ND	2.8	81.4	70	ND	2.8	415	280	ND	70	38.8-B	28	79.8	70	223	140-B	ND	5.6
1,2-Trans-dichloroethylene	ND	1.6	ND	1.6	ND	40	ND	1.6	ND	160	ND	40	ND	16	ND	40	244	80	ND	3.2
Trichloroethylene	ND	1.9	ND	1.9	ND	48	ND	1.9	ND	190	ND	48	ND	19	BMDL	48	5270	95	ND	3.8
bis(Chloromethyl)ether	ND	10.0	ND	10.0	ND	250	ND	10.0	ND	1000	ND	250	ND	100	ND	250	ND	500	ND	20.0
Benzene	ND	4.4	ND	4.4	190	110	BMDL	4.4	519	440	BMDL	110	534	44	501	110	388	230	31.1	8.8
Tetrachloroethylene	ND	4.1	ND	4.1	ND	100	ND	4.1	ND	410	ND	100	ND	41	ND	100	1590	210	ND	8.2
Toluene	ND	6.0	ND	6.0	BMDL	150	ND	6.0	ND	600	ND	150	912	60	1190	150	ND	300	14.6	12.0
Chlorobenzene	ND	6.0	ND	6.0	882	150	65.1	6.0	1230	600	414	150	BMDL	60	ND	150	3060	300	ND	12.0
Ethylbenzene	ND	7.2	ND	7.2	ND	180	ND	7.2	ND	720	ND	180	309	72	243	180	ND	360	ND	14.0
BNA's (ug/L)																				
Phenol	ND	1.6	ND	1.7	73.5	1.8	ND	1.8	1320	8.9	ND	16	888	8.2	53700	17	3600	37	68700	86
2-Chlorophenol	ND	3.6	ND	3.7	ND	4	ND	3.9	ND	20	ND	36	ND	18	ND	38	ND	80	ND	190
2,4-Dimethylphenol	ND	2.9	ND	3	3.82	3.3	ND	3.2	5400	16	ND	29	28500	15	83200	31	581	66	7930	160
2,4-Dichlorophenol	ND	2.9	ND	3	99	3.3	145	3.2	77.3	16	142	29	ND	15	ND	31	ND	66	ND	160
2,4,6-Trichlorophenol	ND	2.9	ND	3	ND	3.3	ND	3.2	ND	16	ND	29	ND	15	ND	31	ND	66	ND	160
1,3-Dichlorobenzene	ND	2.1	ND	2.1	18500	2.3	24600	2.2	26900	11	6030	21	ND	10	152	22	12500	46	ND	110
1,4-Dichlorobenzene	BMDL	4.8	BMDL	4.9	21900	5.3	29500	5.2	29200	26	10400	48	ND	24	279	50	12300	110	ND	250
1,2-Dichlorobenzene	2.58	2.1	BMDL	2.1	19600	2.3	30300	2.2	28100	11	9650	21	ND	10	1570	22	13800	46	ND	110
1,2,4-Trichlorobenzene	ND	2.1	ND	2.1	89.6	2.3	127	2.2	107	11	ND	21	ND	10	ND	22	14400	46	ND	110
Naphthalene	ND	1.7	ND	1.8	111	1.9	55.8	1.9	70.8	9.5	19.6	17	12700	8.7	23700	18	4970	39	58200	92
Acenaphthylene	ND	3.8	ND	3.9	ND	4.2	ND	4.1	ND	21	ND	38	52.9	19	96.3	40	ND	85	ND	200
Acenaphthene	ND	2.1	ND	2.1	6.43	2.3	ND	2.2	BMDL	11	ND	21	264	10	548	22	BMDL	46	2910	110
Fluorene	ND	2.1	ND	2.1	5.51	2.3	ND	2.2	ND	11	ND	21	136	10	303	22	ND	46	ND	110
Hexachlorobenzene	ND	2.1	ND	2.1	ND	2.3	ND	2.2	ND	11	ND	21	ND	10	ND	22	ND	46	ND	110
Phenanthrene	ND	5.9	ND	6.1	BMDL	6.5	ND	6.4	ND	32	ND	59	68.8	29	216	61	ND	130	ND	310
Anthracene	ND	2.1	ND	2.1	ND	2.3	ND	2.2	ND	11	ND	21	23.4	10	69.3	22	ND	46	ND	110
Fluoranthene	ND	2.4	ND	2.5	ND	2.7	ND	2.6	ND	13	ND	24	ND	12	29.7	25	ND	54	ND	130
Pyrene	ND	2.1	ND	2.1	ND	2.3	ND	2.2	ND	11	ND	21	ND	10	BMDL	22	ND	46	ND	110
bis(2-Ethylhexyl)phthalate	ND	11	ND	11	ND	12	ND	12	ND	60	ND	110	11100	54	ND	110	ND	240	ND	570
Phenolics	ND	0.05	ND	0.05	ND	0.05	ND	0.05	6	0.05	0.05	0.05	13	0.05	154	0.05	4	0.05	510	0.05

CONC. - Concentration of Compound

D.L. - Detection Limit

NA - Not analyzed

ND - Not detected

BMDL - Present below detection limit, estimated concentration not reported by laboratory

B - Compound also detected in laboratory blanks

**TABLE 5-11 (Continued)**  
**SUMMARY OF PHASE I GROUNDWATER ANALYTICAL DATA**  
**VOLATILES AND SEMIVOLATILES**  
**SOCC, KEARNY, NJ**

LAB NUMBER SAMPLE NUMBER	IIA3939 MW-10L CONC. D.L.		IIA3958 MW-11L CONC. D.L.		IIA3952 MW-11U CONC. D.L.		IIA3950 MW-12L CONC. D.L.		IIA3955 MW-12U CONC. D.L.		IIA3957 MW-13L CONC. D.L.		IIA3954 MW-13U CONC. D.L.		IIA3956 MW-14L CONC. D.L.		IIA3953 MW-14U CONC. D.L.		IIA3951 MW-15L CONC. D.L.		IIA3946 MW-15U CONC. D.L.	
VOC's (ug/L)																						
Methyl chloride	ND	100	ND	200	ND	200	ND	250	ND	200	267	200	ND	10.0	ND	10.0	ND	10.0	ND	1000	ND	10.0
Dichlorodifluoromethane	ND	100	ND	200	ND	200	ND	250	ND	200	ND	200	ND	10.0	ND	10.0	ND	10.0	ND	1000	ND	10.0
Vinyl chloride	ND	100	ND	200	ND	200	ND	250	ND	200	ND	200	ND	10.0	ND	10.0	ND	10.0	ND	1000	ND	10.0
Methylene chloride	38.9-B	28	73.3	56	ND	56	ND	70	101	100	ND	56	ND	2.8	ND	2.8	BMDL	2.8	ND	289	ND	2.8
1,2-Trans-dichloroethylene	ND	16	ND	32	174	32	ND	40	ND	100	ND	32	ND	1.6	ND	1.6	ND	1.6	ND	160	ND	1.6
Trichloroethylene	ND	19	173	38	96	38	108	48	ND	100	79	38	ND	1.9	121	1.9	ND	1.9	ND	190	ND	1.9
bis(Chloromethyl)ether	ND	100	ND	200	ND	200	ND	250	ND	200	ND	200	ND	10.0	ND	10.0	ND	10.0	ND	1000	ND	10.0
Benzene	108	44	467	88	353	88	337	110	ND	100	118	88	BMDL	4.4	131	4.4	4.59	4.4	3010	440	ND	4.4
Tetrachloroethylene	ND	41	BMDL	82	96.7	82	ND	100	ND	100	BMDL	82	ND	4.1	74.1	4.1	ND	4.1	ND	410	ND	4.1
Toluene	108	60	BMDL	120	BMDL	120	1290	150	ND	100	BMDL	120	BMDL	6.0	115	6.0	20.7	6.0	ND	600	ND	6.0
Chlorobenzene	111	60	1110	120	796	120	743	150	ND	100	200	120	ND	6.0	134	6.0	ND	6.0	1830	600	ND	6.0
Ethylbenzene	BMDL	72	ND	140	ND	140	240	180	ND	100	ND	140	ND	7.2	21.1	7.2	51.1	7.2	ND	720	ND	7.2
BNA's (ug/L)																						
Phenol	ND	16	19100	33	445	1.6	42600	82	6.62	1.7	210000	18	19300	1.7	33500	84	ND	1.7	783	1.7	ND	1.6
2-Chlorophenol	ND	36	ND	73	ND	3.6	ND	180	ND	3.7	ND	39	ND	3.7	ND	190	ND	3.7	63.3	3.7	ND	3.6
2,4-Dimethylphenol	25900	30	1180	59	1830	2.9	20900	150	33.7	3	22800	32	808	3	17500	150	53.3	3	ND	3	ND	3
2,4-Dichlorophenol	ND	30	ND	59	ND	2.9	ND	150	ND	3	ND	32	ND	3	ND	150	ND	3	321	3	ND	3
2,4,6-Trichlorophenol	ND	30	ND	59	ND	2.9	ND	150	15.5	3	ND	32	ND	3	ND	150	ND	3	ND	3	ND	3
1,3-Dichlorobenzene	60.4	21	1570	42	892	2.1	1130	100	65.9	2.1	239	22	25.4	2.1	2650	110	4.1	2.1	15200	2.1	78.6	2.1
1,4-Dichlorobenzene	110	48	2310	97	1910	4.8	2560	240	141	4.9	497	52	51.7	4.9	4610	250	9.56	4.9	19500	4.9	109	4.8
1,2-Dichlorobenzene	156	21	6650	42	5250	2.1	5290	100	145	2.1	771	22	74.2	2.1	2780	110	5.2	2.1	20600	2.1	140	2.1
1,2,4-Trichlorobenzene	ND	21	6070	42	5400	2.1	1520	100	128	2.1	3520	22	166	2.1	14000	110	41.8	2.1	81.2	2.1	ND	2.1
Naphthalene	4990	18	7150	35	9660	1.7	11700	87	426	1.8	16400	19	5020	1.8	5020	90	6540	1.8	20.4	1.8	ND	1.8
Acenaphthylene	ND	38	ND	77	ND	3.8	BMDL	190	8.7	3.9	ND	41	ND	3.9	ND	200	6.88	3.9	ND	3.9	ND	3.8
Acenaphthene	33.7	21	ND	42	22.4	2.1	104	100	117	2.1	308	22	25.5	2.1	ND	110	238	2.1	ND	2.1	ND	2.1
Fluorene	ND	21	ND	42	19.3	2.1	BMDL	100	39.7	2.1	ND	22	ND	2.1	ND	110	57.8	2.1	ND	2.1	ND	2.1
Hexachlorobenzene	ND	21	ND	42	ND	2.1	BMDL	100	ND	2.1	ND	22	ND	2.1	ND	110	ND	2.1	ND	2.1	ND	2.1
Phenanthrene	ND	59	ND	120	15.9	5.9	BMDL	290	41.1	6	ND	64	BMDL	6.1	ND	300	27	6	ND	6	ND	5.9
Anthracene	ND	21	ND	42	9.66	2.1	ND	100	3.63	2.1	ND	22	ND	2.1	ND	110	4.2	2.1	ND	2.1	ND	2.1
Fluoranthene	ND	24	ND	48	ND	2.4	ND	120	4.26	2.4	ND	26	ND	2.5	ND	120	BMDL	2.4	ND	2.4	ND	2.4
Pyrene	ND	21	ND	42	ND	2.1	ND	100	2.1	2.1	ND	22	ND	2.1	ND	110	BMDL	2.1	ND	2.1	ND	2.1
bis(2-Ethylhexyl)phthalate	ND	110	ND	220	ND	11	ND	540	ND	11	ND	120	ND	11	ND	560	ND	11	ND	11	588	11
Phenolics	3620	0.05	96	0.05	5	0.05	110	0.05	NA	NA	2660	0.05	NA	NA	57	0.05	0.17	0.05	ND	0.05	ND	0.05

CONC. - Concentration of Compound

D.L. - Detection Limit

NA - Not analyzed

ND - Not detected

BMDL - Present below detection limit, estimated concentration not reported by laboratory

B - Compound also detected in laboratory blanks

**TABLE 5-11 (Continued)**  
**SUMMARY OF HIASE I GROUNDWATER ANALYTICAL DATA**  
**VOLATILES AND SEMIVOLATILES**  
**SCCC, KEARNY, NJ**

LAB NUMBER SAMPLE NUMBER	HIA3948 FB-1		HIA3947 FB-2		HIA3959 FB-3		HIA3961 TB-1		HIA3960 TB-2		HIA3963 TB-3		HIA3962 IRIP BLANK	
	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.
<b>VOC's (ug/l.)</b>														
Methyl chloride	ND	10.0	ND	10.0	ND	10.0	ND	10.0	ND	10.0	ND	10.0	ND	10.0
Dichlorodifluoromethane	ND	10.0	ND	10.0	ND	10.0	ND	10.0	ND	10.0	ND	10.0	ND	10.0
Vinyl chloride	ND	10.0	ND	10.0	ND	10.0	ND	10.0	ND	10.0	ND	10.0	ND	10.0
Methylene chloride	3.11-B	2.8	2.91-B	2.8	ND	2.8	3.5-B	2.8	3.55-B	2.8	ND	2.8	ND	2.8
1,2-Trans-dichloroethylene	ND	1.6	ND	1.6	ND	1.6	ND	1.6	ND	1.6	ND	1.6	ND	1.6
Trichloroethylene	ND	1.9	ND	1.9	ND	1.9	ND	1.9	ND	1.9	ND	1.9	ND	1.9
bis(Chloromethyl)ether	ND	10.0	ND	10.0	ND	10.0	ND	10.0	ND	10.0	ND	10.0	ND	10.0
Benzene	ND	4.4	ND	4.4	ND	4.4	ND	4.4	ND	4.4	ND	4.4	ND	4.4
Tetrachloroethylene	ND	4.1	ND	4.1	ND	4.1	ND	4.1	ND	4.1	ND	4.1	ND	4.1
Toluene	BMDL-B	6.0	ND	6.0	ND	6.0	ND	6.0	ND	6.0	ND	6.0	ND	6.0
Chlorobenzene	ND	6.0	ND	6.0	ND	6.0	ND	6.0	ND	6.0	ND	6.0	ND	6.0
Ethylbenzene	ND	7.2	ND	7.2	ND	7.2	ND	7.2	ND	7.2	ND	7.2	ND	7.2
<b>BNA's (ug/l.)</b>														
Phenol	ND	1.6	ND	2	ND	1.6								
2-Chlorophenol	ND	3.6	ND	4.5	ND	3.5								
2,4-Dimethylphenol	ND	2.9	ND	3.6	ND	2.8								
2,4-Dichlorophenol	ND	2.9	ND	3.6	ND	2.8								
2,4,6-Trichlorophenol	ND	2.9	ND	3.6	ND	2.8								
1,3-Dichlorobenzene	ND	2.1	ND	2.6	ND	2								
1,4-Dichlorobenzene	ND	4.8	ND	5.9	ND	4.6								
1,2-Dichlorobenzene	ND	2.1	ND	2.6	ND	2								
1,2,4-Trichlorobenzene	ND	2.1	ND	2.6	ND	2								
Naphthalene	ND	1.7	ND	2.2	ND	1.7								
Acenaphthylene	ND	3.8	ND	4.7	ND	3.7								
Acenaphthene	ND	2.1	ND	2.6	ND	2								
Fluorene	ND	2.1	ND	2.6	ND	2								
Hexachlorobenzene	ND	2.1	ND	2.6	ND	2								
Phenanthrene	ND	5.9	ND	7.3	ND	5.7								
Anthracene	ND	2.1	ND	2.6	ND	2								
Fluoranthene	ND	2.4	ND	3	ND	2.3								
Pyrene	ND	2.1	ND	2.6	ND	2								
bis(2-Ethylhexyl)phthalate	ND	11	ND	14	ND	11								
Phenolics	ND	0.05	ND	0.05	ND	0.05								

CONC.-Concentration of Compound

D.L. -Detection Limit

NA -Not analyzed

ND -Not detected

BMDL- Present below detection limit, estimated concentration not reported by laboratory

B -Compound also detected in laboratory blanks

TABLE 5-11 (Continued)  
SUMMARY OF PHASE I GROUNDWATER ANALYTICAL DATA  
METALS  
SCCC, KEARNY, NJ

LAB NUMBER SAMPLE NUMBER	HIA3935 MW-1L CONC. D.L.		HIA3936 MW-11.DUP CONC. D.L.		HIA3941 MW-2L CONC. D.L.		HIA3937 MW-3L CONC. D.L.		HIA3944 MW-4L CONC. D.L.		HIA3943 MW-5L CONC. D.L.		HIA3940 MW-6L CONC. D.L.	
<b>Metals (mg/L)</b>														
Antimony	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06
Arsenic	BMDL	0.05	BMDL	0.05	0.047	0.01	0.13	0.01	0.02	0.02	0.1	0.01	0.042	0.01
Beryllium	0.0014	0.001	0.0013	0.001	ND	0.001	ND	0.001	0.0022	0.001	0.0029	0.001	BMDL	0.001
Cadmium	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	0.0023	0.002	ND	0.002
Chromium	1.87	0.01	1.37	0.01	0.039	0.01	0.014	0.01	1.4	0.01	1.89	0.01	0.18	0.01
Copper	0.026	0.01	0.021	0.01	0.015	0.01	0.011	0.01	0.015	0.01	0.046	0.01	0.014	0.01
Lead	ND	0.075	ND	0.075	BMDL	0.075	ND	0.075	BMDL	0.075	BMDL	0.075	ND	0.075
Mercury	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002
Nickel	0.027	0.02	0.028	0.02	BMDL	0.02	BMDL	0.02	0.045	0.02	0.023	0.02	0.023	0.02
Selenium	BMDL	0.025	BMDL	0.005	ND	0.005	ND	0.005	ND	0.01	ND	0.025	BMDL	0.005
Silver	ND	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.01	BMDL	0.01	BMDL	0.01
Thallium	ND	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.01
Zinc	0.037	0.02	0.034	0.02	BMDL	0.02	BMDL	0.02	0.05	0.02	0.068	0.02	0.074	0.02
Chromium, Hexavalent	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.01	ND	0.01
Cyanide	0.034	0.025	ND	0.025	ND	0.025	0.035	0.025	ND	0.025	0.08	0.025	0.058	0.025

CONC. — Concentration of Compound

D.L. — Detection Limit

ND — Not detected

BMDL — Present below detection limit, estimated concentration not reported by laboratory



TABLE 5-11 (Continued)  
SUMMARY OF PHASE I GROUNDWATER ANALYTICAL DATA  
METALS  
SCCC, KEARNY, NJ

LAB NUMBER SAMPLE NUMBER	IIA3942 MW-7L		IIA3945 MW-8L		IIA3938 MW-9L		IIA3939 MW-10L		IIA3958 MW-11L		IIA3952 MW-11U		IIA3950 MW-12L	
	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.
<b>Metals (mg/L)</b>														
Antimony	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	0.39	0.06	ND	0.06
Arsenic	BMDL	0.05	BMDL	0.02	BMDL	0.25	BMDL	0.05	0.066	0.01	0.13	0.01	BMDL	0.05
Beryllium	0.0028	0.001	0.0021	0.001	0.145	0.001	0.017	0.001	0.003	0.001	0.0026	0.001	0.0028	0.001
Cadmium	ND	0.002	ND	0.002	ND	0.01	ND	0.004	0.013	0.002	0.014	0.002	0.01	0.002
Chromium	0.87	0.01	0.71	0.01	15.8	0.01	4.91	0.01	1.16	0.01	6.64	0.01	0.17	0.01
Copper	0.018	0.01	0.064	0.01	0.57	0.01	0.051	0.01	0.037	0.01	0.9	0.01	0.019	0.01
Lead	ND	0.075	BMDL	0.075	0.61	0.075	0.14	0.075	0.34	0.075	12.5	0.075	BMDL	0.075
Mercury	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	0.00041	0.0002	0.142	0.0002	0.00023	0.0002
Nickel	0.067	0.02	0.026	0.02	6.74	0.02	0.93	0.02	0.46	0.02	0.48	0.02	0.3	0.02
Selenium	ND	0.005	ND	0.005	ND	0.025	ND	0.025	ND	0.005	ND	0.025	ND	0.05
Silver	ND	0.01	ND	0.01	BMDL	0.01	BMDL	0.01	BMDL	0.01	BMDL	0.01	BMDL	0.01
Thallium	ND	0.01	ND	0.01	BMDL	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.01
Zinc	0.039	0.02	0.046	0.02	11.9	0.02	1.3	0.02	0.54	0.02	0.55	0.02	0.31	0.02
Chromium, Hexavalent	ND	0.5	ND	0.05	ND	0.5	ND	0.05	ND	0.01	ND	0.05	ND	0.01
Cyanide	0.092	0.025	0.037	0.025	0.028	0.025	0.067	0.025	0.055	0.025	0.197	0.025	0.07	0.025

CONC. – Concentration of Compound

D.L. – Detection Limit

ND – Not detected

BMDL – Present below detection limit, estimated concentration not reported by laboratory

TABLE 5-11 (Continued)  
SUMMARY OF PHASE I GROUNDWATER ANALYTICAL DATA  
METALS  
SCCC, KEARNY, NJ

LAB NUMBER SAMPLE NUMBER	IIA3955 MW-12U CONC. D.L.		IIA3957 MW-13L CONC. D.L.		IIA3954 MW-13U CONC. D.L.		IIA3956 MW-14L CONC. D.L.		IIA3953 MW-14U CONC. D.L.		IIA3951 MW-15L CONC. D.L.		IIA3946 MW-15U CONC. D.L.	
Metals (mg/L)														
Antimony	BMDL	0.06	0.19	0.06	0.062	0.06	ND	0.06	0.18	0.06	ND	0.06	0.11	0.06
Arsenic	BMDL	0.01	BMDL	0.1	ND	0.01	BMDL	0.05	0.035	0.01	BMDL	0.01	0.024	0.01
Beryllium	BMDL	0.001	0.033	0.001	BMDL	0.001	0.0054	0.001	0.0019	0.001	BMDL	0.001	0.0031	0.001
Cadmium	0.0055	0.002	0.17	0.002	BMDL	0.002	0.021	0.002	0.0076	0.002	0.01	0.002	0.0081	0.002
Chromium	2.3	0.01	67.3	0.01	7.15	0.01	0.9	0.01	20.3	0.01	0.023	0.01	4.2	0.01
Copper	0.077	0.01	0.35	0.01	0.022	0.01	0.058	0.01	0.23	0.01	0.021	0.01	0.26	0.01
Lead	0.6	0.075	0.35	0.075	ND	0.075	0.11	0.075	2.6	0.075	0.82	0.075	44.9	0.075
Mercury	0.0014	0.0002	BMDL	0.0002	0.00033	0.0002	0.00023	0.0002	0.0347	0.0002	ND	0.0002	0.00087	0.0002
Nickel	0.22	0.02	2.95	0.02	0.029	0.02	0.51	0.02	0.36	0.02	ND	0.02	0.13	0.02
Selenium	ND	0.005	BMDL	0.025	ND	0.005	ND	0.005	ND	0.025	ND	0.025	ND	0.025
Silver	ND	0.01	BMDL	0.01	ND	0.01	BMDL	0.01	BMDL	0.01	ND	0.01	BMDL	0.01
Thallium	ND	0.01	BMDL	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.01
Zinc	0.22	0.02	2.53	0.02	0.028	0.02	0.49	0.02	0.64	0.02	0.054	0.02	0.62	0.02
Chromium, Hexavalent	0.081	0.01	ND	0.05	7.38	0.01	ND	0.01	3.32	0.01	ND	0.01	0.088	0.01
Cyanide	ND	0.025	ND	0.025	0.025	0.025	0.073	0.025	0.031	0.025	ND	0.025	ND	0.025

CONC. – Concentration of Compound

D.L. – Detection Limit

ND – Not detected

BMDL – Present below detection limit, estimated concentration not reported by laboratory

TABLE 5-11 (Continued)  
SUMMARY OF PHASE I GROUNDWATER ANALYTICAL DATA  
METALS  
SCCC, KEARNY, NJ

LAB NUMBER SAMPLE NUMBER	HA3948 FB-1 CONC. D.L.		HA3947 FB-2 CONC. D.L.		HA3959 FB-3 CONC. D.L.	
<b>Metals (mg/L)</b>						
Antimony	ND	0.06	ND	0.06	ND	0.06
Arsenic	ND	0.01	ND	0.01	ND	0.01
Beryllium	ND	0.001	ND	0.001	ND	0.001
Cadmium	ND	0.002	ND	0.002	ND	0.002
Chromium	ND	0.01	ND	0.01	BMDL-B	0.01
Copper	ND	0.01	BMDL-B	0.01	ND	0.01
Lead	ND	0.075	ND	0.075	ND	0.075
Mercury	ND	0.0002	ND	0.0002	BMDL-B	0.0002
Nickel	ND	0.02	ND	0.02	ND	0.02
Selenium	ND	0.005	ND	0.005	ND	0.005
Silver	ND	0.01	ND	0.01	ND	0.01
Thallium	ND	0.01	ND	0.01	BMDL-B	0.01
Zinc	ND	0.02	ND	0.02	BMDL-B	0.02
Chromium, Hexavalent	ND	0.01	ND	0.01	ND	0.01
Cyanide	ND	0.1	ND	0.025	ND	0.025

CONC. – Concentration of Compound

D.L. – Detection Limit

ND – Not detected

BMDL – Present below detection limit, estimated concentration not reported by laboratory

B – Compound also detected in laboratory blanks

**TABLE 5-12**  
**SUMMARY OF PHASE II GROUNDWATER ANALYTICAL DATA**  
**VOLATILES, SEMIVOLATILES, AND METALS**  
**SCCC, KIARNY, NJ**

LAB NUMBER	CB2194		CB-2184		CB2187		CB2196		CB2195		CB2189		CB2190		CB2188	
SAMPLE NUMBER	MW-2		MW-3		MW-4		MW-5		MW-8		MW-9		MW-10		MW-12	
	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.
<b>VOC Compound (ug/L)</b>																
Methylene chloride	25 JB	50	65 J	100	180 J	250	56 B	50	420 J	500	32 J	50	28	25	46 JB	100
Vinyl chloride	ND	50	ND	100	ND	250	ND	50	350 J	500	ND	50	ND	25	ND	100
1,2-Dichloroethene	ND	50	ND	100	ND	250	ND	50	190 J	500	82 J	250	ND	25	ND	100
Trichloroethylene	ND	50	ND	100	40 J	250	ND	50	5600	500	ND	50	ND	25	52 J	100
Benzene	55	50	56 J	100	250 J	250	23 J	50	430 J	500	85 J	250	160	25	260	100
Tetrachloroethylene	ND	50	ND	100	ND	250	ND	50	2000	500	40 J	50	ND	25	16 J	100
Toluene	6 JB	50	23 J	100	210 J	250	ND	50	ND	500	ND	50	150	25	770	100
Chlorobenzene	380	50	1100	100	300	250	310	50	5200	500	ND	50	140	25	400	100
Ethylbenzene	ND	50	ND	100	52 J	250	ND	50	ND	500	ND	50	73	25	100	100
Carbon disulfide	ND	50	ND	100	ND	250	ND	50	ND	500	ND	50	ND	25	ND	100
Xylene (total)	ND	50	ND	100	95 J	250	ND	50	120 J	500	47 J	250	400	25	600	100
Styrene	ND	50	ND	100	ND	250	ND	50	ND	500	ND	50	ND	25	92 J	100
Acetone	ND	50	ND	100	ND	250	ND	50	ND	500	500	250	310	25	ND	100
<b>BNAs (ug/L)</b>																
Phenol	ND	560	ND	530	150 J	530	31 J	62	2100	670	360000	56000	230000	31000	91000	26000
2-Chlorophenol	58 J	560	ND	530	ND	530	25 J	62	ND	670	ND	56000	ND	620	ND	26000
2-Methylphenol	670	560	ND	530	570	530	ND	62	450 J	670	180000	56000	580000	31000	380000	260000
2,4-Dichlorophenol	180 J	560	120 J	530	ND	530	190	62	ND	670	ND	56000	ND	620	ND	26000
2,4,6-Trichlorophenol	ND	560	ND	530	ND	530	ND	62	ND	670	ND	56000	ND	620	ND	26000
1,3-Dichlorobenzene	9800	2200	7500	2100	8000	2100	3000	620	150000	33000	ND	56000	ND	620	2800	26000
1,4-Dichlorobenzene	14000	2200	11000	2100	11000	2100	4900	620	180000	33000	ND	56000	380 J	620	5400	26000
1,2-Dichlorobenzene	13000	2200	11000	2100	9600	2100	5100	620	160000	33000	ND	56000	640	620	120000	26000
1,2,4-Trichlorobenzene	140 J	560	62 J	530	120 J	530	ND	62	120000	33000	ND	56000	ND	620	5600	26000
Naphthalene	ND	560	ND	530	68 J	530	ND	62	7200	33000	ND	56000	2400	620	190000	26000
Acenaphthalene	ND	560	ND	530	ND	530	ND	62	ND	670	ND	56000	ND	620	ND	26000
Acenaphthene	ND	560	ND	530	ND	530	ND	62	ND	670	ND	56000	ND	620	ND	26000
Fluorene	ND	560	ND	530	ND	530	ND	62	ND	670	ND	56000	ND	620	ND	26000
Hexachlorobenzene	ND	560	ND	530	ND	530	ND	62	ND	670	ND	56000	ND	620	ND	26000
Phenanthrene	ND	560	ND	530	ND	530	ND	62	ND	670	ND	56000	ND	620	ND	26000
Anthracene	ND	560	ND	530	ND	530	ND	62	ND	670	ND	56000	ND	620	ND	26000
Fluoranthene	ND	560	ND	530	ND	530	ND	62	ND	670	ND	56000	ND	620	ND	26000
Pyrene	ND	560	ND	530	ND	530	ND	62	ND	670	ND	56000	ND	620	ND	26000
bis(2-Ethylhexyl)phthalate	ND	560	ND	530	ND	530	ND	62	ND	670	ND	56000	ND	620	ND	26000
4-Methylphenol	ND	560	ND	530	710	530	ND	62	1700	670	170000	56000	200000	31000	140000	260000
2,4-Dimethylphenol	ND	560	ND	530	3200	530	ND	62	920	670	6800	56000	31000 J	31000	38000	260000
2-Methylnaphthalene	ND	560	ND	530	ND	530	ND	62	150 J	670	ND	56000	960	620	1500 J	26000
Di-benzofuran	ND	560	ND	530	ND	530	ND	62	ND	670	ND	56000	ND	620	ND	26000
<b>Metals (ug/L)</b>																
Chromium	22.6	10	27.8	10	1210	10	5100	10	1440	10	9560	10	1290	10	118	10
Lead	7.74	1	6.62	1	1.78	1	ND	1	41.6	1	ND	1	3.79	1	8.52	1

CONC. - Concentration of compound  
D.L. - Detection Limit  
ND - Not detected  
NA - Not analyzed  
J - Estimated concentration of compound detected below the detection limit  
B - Analyte found in laboratory blank sample

**TABLE 5-12 (Continued)**  
**SUMMARY OF PHASE II GROUNDWATER ANALYTICAL DATA**  
**VOLATILES, SEMIVOLATILES, AND METALS**  
**SCCC, KEARNY, NJ**

LAB NUMBER SAMPLE NUMBER	CB2185 MW-14L		CB2191 MW-14L Dup		CB2192 MW-15		CB2718 TPZ-1		CB2186 TPZ-2		CB2197 Field Blank		CB2200 Trip Blank	
	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.
<b>VOC Compound (ug/L.)</b>														
Methylene chloride	27 B	20	16 J	20	190 J	250	3 JB	10	6 J	10	7 J	10	7 J	10
Vinyl chloride	ND	20	ND	20	ND	250	ND	10	ND	10	ND	10	ND	10
1,2-Dichloroethene	ND	20	ND	20	ND	250	ND	10	ND	10	ND	10	ND	10
Trichloroethylene	71	20	75	20	ND	250	2 JB	10	ND	10	ND	10	ND	10
Benzene	140	20	140	20	1700	250	3 J	10	ND	10	ND	10	ND	10
Tetrachloroethylene	24	20	21	20	ND	250	ND	10	ND	10	ND	10	ND	10
Toluene	200	20	210	20	ND	250	ND	10	4 J	10	ND	10	ND	10
Chlorobenzene	48	20	51	20	1200	250	ND	10	ND	10	ND	10	ND	10
Ethylbenzene	55	20	63	20	ND	250	ND	10	ND	10	ND	10	ND	10
Carbon disulfide	25	20	30	20	ND	250	ND	10	ND	10	ND	10	ND	10
Xylene (total)	200	20	250	20	ND	250	ND	10	ND	10	ND	10	ND	10
Styrene	ND	20	ND	20	ND	250	ND	10	ND	10	ND	10	ND	10
Acetone	ND	20	ND	20	ND	250	7 J	10	ND	10	ND	10	ND	10
<b>BNAs (ug/L.)</b>														
Phenol	31000	11000	29000	11000	280 J	560	ND	10	ND	13	ND	10	NA	NA
2-Chlorophenol	ND	560	ND	560	58 J	560	ND	10	ND	13	ND	10	NA	NA
2-Methylphenol	14000	11000	14000	11000	ND	560	ND	10	ND	13	ND	10	NA	NA
2,4-Dichlorophenol	ND	560	ND	560	350 J	560	ND	10	ND	13	ND	10	NA	NA
2,4,6-Trichlorophenol	ND	560	ND	560	ND	560	ND	10	ND	13	ND	10	NA	NA
1,3-Dichlorobenzene	1900	560	1400	560	21000	5600	ND	10	ND	13	ND	10	NA	NA
1,4-Dichlorobenzene	2700	560	2100	560	33000	5600	ND	10	ND	13	ND	10	NA	NA
1,2-Dichlorobenzene	2100	560	1600	560	33000	5600	ND	10	ND	13	ND	10	NA	NA
1,2,4-Trichlorobenzene	26000	11000	21000	11000	190 J	560	ND	10	ND	13	ND	10	NA	NA
Naphthalene	6400 J	11000	4700	560	ND	560	6 J	10	3 J	13	ND	10	NA	NA
Acenaphthalene	ND	560	ND	560	ND	560	ND	10	ND	13	ND	10	NA	NA
Acenaphthene	180 J	560	140 J	560	ND	560	2 J	10	4 J	13	ND	10	NA	NA
Fluorene	32 J	560	ND	560	ND	560	ND	10	3 J	13	ND	10	NA	NA
Hexachlorobenzene	ND	560	ND	560	ND	560	ND	10	ND	13	ND	10	NA	NA
Phenathrene	ND	560	ND	560	ND	560	ND	10	10 J	13	ND	10	NA	NA
Anthracene	ND	560	ND	560	ND	560	ND	10	ND	13	ND	10	NA	NA
Fluoranthene	ND	560	ND	560	ND	560	2 J	10	6 J	13	ND	10	NA	NA
Pyrene	ND	560	ND	560	ND	560	2 J	10	6 J	13	ND	10	NA	NA
bis(2-Ethylhexyl)phthalate	ND	560	ND	560	ND	560	8 JB	10	ND	13	ND	10	NA	NA
4-Methylphenol	48000	11000	46000	11000	ND	560	ND	10	ND	13	ND	10	NA	NA
2,4-Dimethylphenol	18000	11000	17000	11000	ND	560	14	10	ND	13	ND	10	NA	NA
2-Methylnaphthalene	770	560	590	560	ND	560	ND	10	ND	13	ND	10	NA	NA
Di-benzofuran	69 J	560	ND	560	ND	560	ND	10	ND	13	ND	10	NA	NA
<b>Metals (ug/L.)</b>														
Chromium	272	10	278	10	18.1	10	155	10	35.5	10	ND	10	NA	NA
Lead	21.2	1	ND	1	848	1	61.1	1	13.7	1	ND	1	NA	NA

CONC. – Concentration of compound  
D.L. – Detection Limit  
ND – Not detected  
NA – Not analyzed  
J – Estimated concentration of compound detected below the detection limit  
B – Analyte found in laboratory blank sample

## **1997-1999 Supplemental Remedial Investigation**

#### **A.4 Bedrock Groundwater Data**

TABLE 3-3

**GROUNDWATER ANALYTICAL RESULTS**  
**STANDARD CHLORINE CHEMICAL COMPANY**

CONSTITUENT: (Units in ug/l)	NEW JERSEY CLASS II-A GROUNDWATER QUALITY CRITERIA	SITE: DATE:	SC-MW-16L 2/2/99	SC-MW-17L 2/2/99	SC-MW-17L 2/2/99  DILUTED SAMPLE
Benzo(a)pyrene	0.003		< 50	< 10	< 1000
2,4-Dinitrophenol	10		< 250	< 50	< 5000
Dibenz(a,h)anthracene	0.003		< 50	< 10	< 1000
Benzo(a)anthracene	0.03		< 50	< 10	< 1000
4-Chloro-3-methylphenol			< 50	< 10	< 1000
Hexachloroethane	0.7		< 50	< 10	< 1000
Hexachlorocyclopentadiene	50		< 50	< 10	< 1000
Isophorone	100		< 50	< 10	< 1000
Acenaphthene	400		< 50	< 10	< 1000
Diethylphthalate	5000		< 50	< 10	< 1000
Di-n-butylphthalate	900		< 50	< 10	< 1000
Phenanthrene			< 50	< 10	< 1000
Butyl benzyl phthalate	100		< 50	< 10	< 1000
N-Nitrosodiphenylamine	7		< 50	< 10	< 1000
Fluorene	300		< 50	< 10	< 1000
Carbazole			< 50	< 10	< 1000
Hexachlorobutadiene	1		< 50	< 10	< 1000
Pentachlorophenol	0.3		< 250	< 50	< 5000
2,4,6-Trichlorophenol	3		< 50	< 10	< 1000
2-Nitroaniline			< 250	< 50	< 5000
2-Nitrophenol			< 50	< 10	< 1000
Naphthalene			6 J	12	< 1000
2-Methylnaphthalene			< 50	< 10	< 1000
2-Chloronaphthalene			< 50	< 10	< 1000
3,3'-Dichlorobenzidine	0.08		< 50	< 10	< 1000
2-Methylphenol			< 50	< 10	< 1000
1,2-Dichlorobenzene	600		330	[3800] E	[12000] D
2-Chlorophenol	40		< 50	25	< 1000
2,4,5-Trichlorophenol	700		< 250	< 50	< 5000
Nitrobenzene	3		< 50	< 10	< 1000
3-Nitroaniline			< 250	< 50	< 5000
4-Nitroaniline			< 250	< 50	< 5000
4-Nitrophenol			< 250	< 50	< 5000
4-Bromophenyl phenyl ether			< 50	< 10	< 1000
2,4-Dimethylphenol	100		< 50	< 10	< 1000
4-Methylphenol			< 50	< 10	< 1000
1,4-Dichlorobenzene	75		[540]	[3500] E	[11000] D
4-Chloroaniline			< 50	< 10	< 1000
Phenol	4000		< 50	< 10	< 1000
Bis(2-chloroethyl)ether	0.03		< 50	< 10	< 1000
Bis(2-chloroethoxy) methane			< 50	< 10	< 1000
Bis(2-ethylhexyl)phthalate	3		< 50	< 10	< 1000
Di-n-octylphthalate	100		< 50	< 10	< 1000
Hexachlorobenzene	0.02		< 50	< 10	< 1000
Anthracene	2000		< 50	< 10	< 1000
1,2,4-Trichlorobenzene	9		< 50	[17]	< 1000
2,4-Dichlorophenol	20		< 50	6 J	< 1000
2,4-Dinitrotoluene	0.05		< 50	< 10	< 1000
Pyrene	200		< 50	< 10	< 1000



TABLE 3-3

GROUNDWATER ANALYTICAL RESULTS  
STANDARD CHLORINE CHEMICAL COMPANY

CONSTITUENT: (Units in ug/l)	NEW JERSEY CLASS II-A GROUNDWATER QUALITY CRITERIA	SITE: DATE:	SC-MW-16L 2/2/99	SC-MW-17L 2/2/99	SC-MW-17L 2/2/99  DILUTED SAMPLE
Dimethylphthalate	7000		< 50	< 10	< 1000
Dibenzofuran			< 50	< 10	< 1000
Benzo(g,h,i)perylene			< 50	< 10	< 1000
Indeno(1,2,3-cd)pyrene	0.03		< 50	< 10	< 1000
Benzo(b)fluoranthene	0.03		< 50	< 10	< 1000
Fluoranthene	300		< 50	< 10	< 1000
Benzo(k)fluoranthene	0.03		< 50	< 10	< 1000
Acenaphthylene			< 50	< 10	< 1000
Chrysene	0.03		< 50	< 10	< 1000
4,6-Dinitro-2-methylphenol			< 250	< 50	< 5000
1,3-Dichlorobenzene	600		460	[4100] E	[7400] D
2,6-Dinitrotoluene			< 50	< 10	< 1000
N-Nitrosodi-n-propylamine	0.005		< 50	< 10	< 1000
4-Chlorophenyl phenyl ether			< 50	< 10	< 1000
2,2'-oxybis(1-chloropropane)			< 50	< 10	< 1000

[ ] - Indicates sample concentration greater than New Jersey Class II-A Groundwater Quality Criteria.

J - Estimated concentration less than the method detection limit.

D - Sample concentration determined by analysis of diluted sample.

E - Estimated minimum value, concentration greater than instrument calibration range.

**1997-1999 Supplemental Remedial Investigation**

TABLE 2-1A

**FORMER PRODUCTION WELL  
GROUNDWATER ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS  
STANDARD CHLORINE CHEMICAL COMPANY**

SITE: SAMPLE ID: DATE: DEPTH (ft):		SC-PW PW-88 10/8/98 88	SC-PW PW-228 10/8/98 228	SC-PW PW-360 10/8/98 360
CONSTITUENT:	UNITS			
1,1,1-Trichloroethane	ug/L	0.5 U	0.5 U	0.5 U
1,1,2,2-Tetrachloroethane	ug/L	0.9 U	0.9 U	0.9 U
1,1,2-Trichloroethane	ug/L	1.9 U	1.9 U	1.9 U
1,1-Dichloroethane	ug/L	0.6 U	0.6 U	0.6 U
1,1-Dichloroethylene	ug/L	1.1 U	1.1 U	1.1 U
1,2-Dichloroethane	ug/L	1.3 U	1.3 U	1.3 U
1,2-Dichloropropane	ug/L	0.5 U	0.5 U	0.5 U
2-Hexanone	ug/L	3 U	3 U	3 U
Acetone	ug/L	38 B	10 B	6.2 JB
Benzene	ug/L	0.7 U	0.7 U	0.7 U
Bromodichloromethane	ug/L	0.8 U	0.8 U	0.8 U
Bromoform	ug/L	2.5 U	2.5 U	2.5 U
Carbon disulfide	ug/L	2.4 U	2.4 U	2.4 U
Carbon tetrachloride	ug/L	1 U	1 U	1 U
Chlorobenzene	ug/L	1.1 U	1.1 U	1.1 U
Chloroethane	ug/L	1.3 U	1.3 U	1.3 U
Chloroform	ug/L	0.8 U	0.8 U	0.8 U
cis-1,2-Dichloroethylene	ug/L	0.8 U	0.8 U	0.8 U
cis-1,3-Dichloropropene	ug/L	0.7 U	0.7 U	0.7 U
Dibromochloromethane	ug/L	1.7 U	1.7 U	1.7 U
Ethylbenzene	ug/L	2.2 U	2.2 U	2.2 U
Methyl bromide	ug/L	2.3 U	2.3 U	2.3 U
Methyl chloride	ug/L	7.7 U	7.7 U	7.7 U
Methyl ethyl ketone	ug/L	2.5 JB	2.4 JB	2.5 U
Methyl isobutyl ketone (MIBK)	ug/L	2.7 U	2.7 U	2.7 U
Methylene chloride	ug/L	1.2 U	1.2 U	1.2 U
Styrene	ug/L	1.8 U	1.8 U	1.8 U
Tetrachloroethylene	ug/L	0.8 U	0.8 U	0.8 U
Toluene	ug/L	0.8 U	0.8 U	0.8 U
trans-1,2-Dichloroethene	ug/L	0.7 U	0.7 U	0.7 U
trans-1,3-Dichloropropene	ug/L	1.5 U	1.5 U	1.5 U
Trichloroethylene	ug/L	0.6 U	0.6 U	0.6 U
Vinyl chloride	ug/L	1.2 U	1.2 U	1.2 U
Xylenes	ug/L	1.3 U	1.3 U	1.3 U

U indicates constituent not detected at listed detection limit.

B indicates constituent detected in associated blank.

J indicates estimated constituent value.

TABLE 2-1B

**FORMER PRODUCTION WELL  
GROUNDWATER ANALYTICAL RESULTS FOR SEMI-VOLATILE ORGANIC COMPOUNDS  
STANDARD CHLORINE CHEMICAL COMPANY**

SITE: SAMPLE ID: DATE: DEPTH (ft):		SC-PW PW-88 10/8/98 88	SC-PW PW-228 10/8/98 228	SC-PW PW-360 10/8/98 360
CONSTITUENT:	UNITS			
<b>SEMI-VOLATILES</b>				
1,2,4-Trichlorobenzene	ug/L	0.44 U	0.44 U	0.44 U
2,4,5-Trichlorophenol	ug/L	0.42 U	0.42 U	0.42 U
2,4,6-Trichlorophenol	ug/L	0.58 U	0.58 U	0.58 U
2,4-Dichlorophenol	ug/L	0.54 U	0.54 U	0.54 U
2,4-Dimethylphenol	ug/L	0.54 U	0.54 U	0.54 U
2,4-Dinitrophenol	ug/L	12 U	12 U	12 U
2,4-Dinitrotoluene	ug/L	0.28 U	0.28 U	0.28 U
2,6-Dinitrotoluene	ug/L	0.39 U	0.39 U	0.39 U
2-Chloronaphthalene	ug/L	0.42 U	0.42 U	0.42 U
2-Chlorophenol	ug/L	0.85 U	0.85 U	0.85 U
2-Methylnaphthalene	ug/L	0.34 U	0.34 U	0.34 U
3,3-Dichlorobenzidine	ug/L	3.6 U	3.6 U	3.6 U
4,6-Dinitro-o-cresol	ug/L	0.45 U	0.45 U	0.45 U
4-Bromophenyl phenyl ether	ug/L	0.6 U	0.6 U	0.6 U
4-Chlorophenyl phenyl ether	ug/L	0.4 U	0.4 U	0.4 U
Acenaphthene	ug/L	0.48 U	0.48 U	0.48 U
Acenaphthylene	ug/L	0.38 U	0.38 U	0.38 U
Anthracene	ug/L	0.41 U	0.41 U	0.41 U
Benzo(a)anthracene	ug/L	2.2	2.4	3
Benzo(a)pyrene	ug/L	3.8	4.4	5.6
Benzo(b)fluoranthene	ug/L	5.2	4.9	6.9
Benzo(ghi)perylene	ug/L	3.5	4.2	5.3
Benzo(k)fluoranthene	ug/L	1.3	1.9	2.2
Bis(2-chloro-1-methylethyl) ether	ug/L	0.68 U	0.68 U	0.68 U
Bis(2-chloroethoxy)methane	ug/L	0.39 U	0.39 U	0.39 U
Bis(2-chloroethyl)ether	ug/L	0.28 U	0.28 U	0.28 U
Bis(2-ethylhexyl)phthalate (BEHP)	ug/L	1.9	5.4	5.8
Butyl benzyl phthalate	ug/L	0.54 U	0.54 U	0.54 U
Carbazole	ug/L	0.41 U	0.41 U	0.41 U
Carbolic acid	ug/L	0.45 U	0.45 U	0.45 U
Chrysene	ug/L	2.6	3	4.1
Dibenzo(a,h)anthracene	ug/L	0.47 U	0.47 U	1
Dibenzofuran	ug/L	0.42 U	0.42 U	0.42 U
Diethyl phthalate	ug/L	0.45 U	0.45 U	0.45 U
Dimethyl phthalate	ug/L	0.43 U	0.43 U	0.43 U
Di-n-butyl phthalate	ug/L	0.85 U	0.85 U	0.85 U

TABLE 2-1B

**FORMER PRODUCTION WELL  
GROUNDWATER ANALYTICAL RESULTS FOR SEMI-VOLATILE ORGANIC COMPOUNDS  
STANDARD CHLORINE CHEMICAL COMPANY**

SITE: SAMPLE ID: DATE: DEPTH (ft):		SC-PW PW-88 10/8/98 88	SC-PW PW-228 10/8/98 228	SC-PW PW-360 10/8/98 360
CONSTITUENT:	UNITS			
<b>SEMI-VOLATILES (Continued)</b>				
Di-n-octyl phthalate	ug/L	0.43 U	0.43 U	0.43 U
Fluoranthene	ug/L	2.8	3	3.7
Fluorene	ug/L	0.33 U	0.33 U	0.33 U
Hexachlorobenzene	ug/L	0.39 U	0.39 U	0.39 U
Hexachlorobutadiene	ug/L	0.54 U	0.54 U	0.54 U
Hexachlorocyclopentadiene	ug/L	1.5 U	1.5 U	1.5 U
Hexachloroethane	ug/L	0.5 U	0.5 U	0.5 U
Indeno(1,2,3-cd)pyrene	ug/L	2.8	3.4	4.3
Isophorone	ug/L	0.3 U	0.3 U	0.3 U
m-Dichlorobenzene	ug/L	0.5 U	0.5 U	0.5 U
m-Nitroaniline	ug/L	1.4 U	1.4 U	1.4 U
Naphthalene	ug/L	0.38 U	0.38 U	0.38 U
Nitrobenzene	ug/L	0.36 U	0.36 U	0.36 U
N-Nitrosodiphenylamine	ug/L	0.42 U	0.42 U	0.42 U
N-Nitrosodipropylamine	ug/L	0.39 U	0.39 U	0.39 U
o-Cresol	ug/L	0.71 U	0.71 U	0.71 U
o-Dichlorobenzene	ug/L	0.61 U	0.61 U	0.61 U
o-Nitroaniline	ug/L	0.43 U	0.43 U	0.43 U
o-Nitrophenol	ug/L	0.58 U	0.58 U	0.58 U
p-Chloroaniline	ug/L	0.25 U	0.25 U	0.25 U
p-Chloro-m-cresol	ug/L	0.57 U	0.57 U	0.57 U
p-Cresol	ug/L	0.24 U	0.24 U	0.24 U
p-Dichlorobenzene	ug/L	0.59 U	0.59 U	0.59 U
Pentachlorophenol	ug/L	0.48 U	0.48 U	0.48 U
Phenanthrene	ug/L	1.3	1.3	1.6
p-Nitroaniline	ug/L	0.35 U	0.35 U	0.35 U
p-Nitrophenol	ug/L	4.9 U	4.9 U	4.9 U
Pyrene	ug/L	2.6	3	0.43 U

U indicates constituent not detected at listed detection limit.

TABLE 2-1C

**FORMER PRODUCTION WELL  
GROUNDWATER ANALYTICAL RESULTS FOR METALS  
STANDARD CHLORINE CHEMICAL COMPANY**

SITE: SAMPLE ID: DATE: DEPTH (ft):		SC-PW PW-88 10/8/98 88	SC-PW PW-228 10/8/98 228	SC-PW PW-360 10/8/98 360
CONSTITUENT: UNITS				
Aluminum	ug/L	798	527	533
Antimony	ug/L	2.31 B	1.7 B	1.65 B
Arsenic	ug/L	2.12 B	1.525 U	1.8 B
Barium	ug/L	35.3	67.7	213
Beryllium	ug/L	0.19 B	0.27 B	0.44 B
Cadmium	ug/L	0.215 B	0.125 B	0.125 B
Calcium	ug/L	28300	30500	105000
Chromium	ug/L	989	819	890
Cobalt	ug/L	3.17 B	2.3 B	2.04 B
Copper	ug/L	15.9	33.7	30.6
Iron	ug/L	3590	2630	2070
Lead	ug/L	16.4	12.9	11.6
Magnesium	ug/L	10400	14800	77200
Manganese	ug/L	55.2	33	48.1
Mercury	ug/L	0.2 U	0.2 U	0.2 U
Nickel	ug/L	86.8	65.8	59.3
Potassium	ug/L	17000	14900	37700
Selenium	ug/L	2.63	2.02 B	3.98
Silver	ug/L	0.294 U	0.294 U	0.294 U
Sodium	ug/L	178000	232000	695000
Thallium	ug/L	2.66 B	2.36 B	2.75 B
Vanadium	ug/L	167	163	146
Zinc	ug/L	52.8	43.5	38.3

U indicates constituent not detected at listed detection limit.

B indicates reported value is < CRDL but > IDL

## **A.5 DNAPL Data**

## **1996-1997 Focused Remedial Investigation**



Table 2-2

## DNAPL Characterization Sampling Results

Standard Chlorine Chemical Company

Kearny, New Jersey

Well No.	MV-8L	MW-12L	MW-13L	MW-14L	Practical	EB-1	TB-1
Date Sampled	9/19/95	9/19/95	9/19/95	9/19/95	Quantitation	9/19/95	9/19/95
Time Sampled	1200	1320	1250	1235	Limit	1225	1400
ERM TR#	7461	7465	7464	7563	(mg/kg)	7462	7466
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)		(mg/L)	(mg/L)
trichloroethylene	8,600	U	U	U	2,500	U	U
tetrachloroethylene	11,000	U	U	U	2,500	U	U
chlorobenzene	9,000	1,700 J	U	U	2,500	U	U
1,3-dichlorobenzene	74,000 J	40,000	3,600 J	41,000	5,000	U	U
1,2-dichlorobenzene	160,000	99,000	12,000	45,000	5,000	U	U
1,4-dichlorobenzene	68,000 J	49,000	6,500	54,000 J	5,000	U	U
naphthalene	41,000 J	200,000	150,000	75,000	2,500	U	U
1,2,4-trichlorobenzene	620,000	160,000	99,000	770,000	2,500	U	U
viscosity (SSU)	30	NA	37	NA		NA	NA
specific gravity (unitless)	1.3789	NA	1.3373	NA		NA	NA

## Notes:

J: Indicates an estimated value

U: Indicates compounds was analyzed for but not detected

NA: Not analyzed

EB: Equipment blank

TB: Travel Blank

**Table 3-2**  
**Summary of FRI DNAPL Measurements**  
*Standard Chlorine Chemical Company*  
*Kearny, New Jersey Facility*

<i>Well No.</i>	<i>Date</i>	<i>DNAPL Thickness (ft)**</i>	<i>Approx. Depth Well is Set into Confining Clay (ft)</i>
MW-4L	7/15/96	0.25	-
PZ-4D	7/15/96	1.20	-
MW-8L	7/15/96	2.26	2.4
MW-12L	7/15/96	1.34	2.1
MW-13L	7/15/96	1.91	1.5
MW-14L	7/15/96	0.90	1.5

## **A.6 Surface Water/Sediment Data**

**1990-1993 Remedial Investigation  
Surface Water/Sediment**

**TABLE 5-7**  
**SUMMARY OF SURFACE WATER ANALYTICAL DATA**  
**VOLATILES AND SEMIVOLATILES**  
**SCCC, KIARNEY, NJ**

LAB NUMBER SAMPLE NUMBER	IIA-3586 SSW-1		IIA-3588 SSW-2		IIA-3584 SSW-3		IIA-3587 SSW-4		IIA-3585 SSW-5		IIA-3558 SSW-5-Dup		CB2717 SSW-6		IIA-3575 Field Blank		IIA-3602 Trip Blank	
	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.
<b>VOC Compound (ug/l.)</b>																		
Benzene	ND	22.0	9.7	4.4	ND	22.0	39.8	22.0	7.9	4.4	6.1	4.4	ND	10	ND	4.4	ND	4.4
Chlorobenzene	414.0	30.0	86.0	6.0	332.0	30.0	329.0	30.0	128.0	6.0	107.0	6.0	ND	10	ND	6.0	ND	6.0
Ethylbenzene	ND	36.0	BMDL	7.2	ND	36.0	ND	36.0	BMDL	7.2	ND	7.2	ND	10	ND	7.2	ND	7.2
Methylene chloride	ND	14.0	BMDL	2.8	ND	14.0	ND	14.0	ND	2.8	ND	2.8	3 J	10	ND	2.8	ND	10.0
1,2-Trans-dichloroethene	ND	8.0	ND	1.6	ND	8.0	21.0	8.0	1.7	1.6	1.7	1.6	ND	10	ND	1.6	ND	1.6
Toluene	ND	30.0	6.2	6.0	BMDL	30.0	ND	30.0	BMDL	6.0	ND	6.0	ND	10	BMDL	6.0	BMDL	6.0
Trichloroethene	ND	9.5	ND	1.9	ND	9.5	ND	9.5	ND	1.9	ND	1.9	ND	10	2.0	1.9	ND	1.9
Xylenes	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	10	NA	NA	NA	NA
<b>BNA Compound (ug/l.)</b>																		
Acenaphthene	ND	2.0	12.3	2.0	ND	2.1	ND	2.0	ND	2.2	ND	2.1	93	57	ND	2.0	NA	NA
Acenaphthylene	ND	3.6	BMDL	3.7	ND	3.8	ND	3.7	ND	4.0	ND	3.8	ND	57	ND	3.7	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	52 J	57	NA	NA	NA	NA
1,2-Dichlorobenzene	171.0	2.0	224.0	2.0	542.0	2.1	2740.0	2.0	321.0	2.2	320.0	2.1	170	57	ND	2.0	NA	NA
1,3-Dichlorobenzene	296.0	2.0	85.5	2.0	432.0	2.1	2920.0	2.0	278.0	2.2	288.0	2.1	82	57	ND	2.0	NA	NA
1,4-Dichlorobenzene	369.0	4.6	192.0	4.6	517.0	4.8	4680.0	4.7	385.0	5.0	394.0	4.8	240	57	ND	4.7	NA	NA
Fluorene	ND	2.0	2.8	2.0	ND	2.1	ND	2.0	ND	2.2	ND	2.1	26 J	57	ND	2.0	NA	NA
Isophorone	ND	2.3	ND	2.3	ND	2.4	ND	2.3	5.2	2.5	5.5	2.4	ND	57	ND	2.3	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	41 J	57	NA	NA	NA	NA
2-Methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	340	57	NA	NA	NA	NA
Naphthalene	9.1	1.7	260.0	1.7	16.4	1.8	4.0	1.7	7.1	1.8	6.8	1.7	81	57	ND	1.7	NA	NA
Phenanthrene	ND	5.6	BMDL	5.7	ND	5.9	ND	5.7	ND	6.1	ND	5.9	9 J	57	ND	5.7	NA	NA
1,2,4-Trichlorobenzene	ND	2.0	78.5	2.0	49.3	2.1	51.0	2.0	30.2	2.2	30.4	2.1	34 J	57	ND	2.0	NA	NA
2-Chlorophenol	3.9	3.4	ND	3.5	3.8	3.6	ND	3.5	BMDL	3.8	BMDL	3.6	ND	57	ND	3.5	NA	NA
2,4-Dichlorophenol	BMDL	2.8	ND	2.8	ND	3.0	19.8	2.9	ND	3.1	7.1	2.9	ND	57	ND	2.9	NA	NA
2,4-Dimethylphenol	17.6	2.8	60.4	2.8	ND	3.0	ND	2.9	ND	3.1	ND	2.9	1000	230	ND	2.9	NA	NA
Phenol	29.0	1.6	241.0	1.6	ND	1.6	ND	1.6	ND	1.7	ND	1.6	8 J	57	ND	1.6	NA	NA
Phenolics	0.07	0.05	0.43	0.05	ND	0.05	0.05	0.05	ND	0.05	ND	0.05	NA	NA	NA	NA	NA	NA

CONC. - Concentration of compound

D.L. - Detection Limit

ND - Not detected

NA - Not analyzed

J - Estimated concentration of compound detected below the detection limit

BMDL - Present below method detection limit, estimated concentration not reported by laboratory

**TABLE 5-7 (Continued)**  
**SUMMARY OF SURFACE WATER ANALYTICAL DATA**  
**METALS**  
**SCCC, KEARNY, NJ**

LAB NUMBER SAMPLE NUMBER	IIA-3586 SSW-1		IIA-3588 SSW-2		IIA-3584 SSW-3		IIA-3587 SSW-4		IIA-3585 SSW-5		IIA-3558 SSW-5-Dup		CB2717 SSW-6	
	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.
<b>Metals (mg/L)</b>														
Antimony	BMDL	0.060	ND	0.060	ND	0.060	BMDL	0.060	ND	0.060	ND	0.060	ND	24
Arsenic	ND	0.010	ND	0.010	ND	0.010	0.010	0.010	ND	0.010	ND	0.010	BMDL	5
Beryllium	ND	0.001	ND	0.001	ND	0.001	0.002	0.001	ND	0.001	ND	0.001	ND	0.2
Cadmium	BMDL	0.002	BMDL	0.002	0.002	0.002	0.017	0.002	0.003	0.002	0.003	0.002	ND	3
Chromium	6.290	0.010	0.320	0.010	0.480	0.010	8.640	0.010	0.160	0.010	0.540	0.010	1240	10
Copper	0.023	0.010	BMDL	0.010	BMDL	0.010	0.200	0.010	BMDL	0.010	0.020	0.010	173	10
Lead	ND	0.075	ND	0.075	ND	0.075	1.000	0.075	BMDL	0.075	0.260	0.075	136	1
Mercury	BMDL	0.000	BMDL	0.000	ND	0.000	ND	0.000	ND	0.000	0.000	0.000	19.4	0.2
Nickel	ND	0.020	BMDL	0.020	BMDL	0.020	0.350	0.020	0.037	0.020	0.046	0.020	982	20
Selenium	ND	0.005	ND	0.005	ND	0.005	0.005	0.005	BMDL	0.005	BMDL	0.005	ND	2
Silver	0.013	0.010	BMDL	0.010	BMDL	0.010	BMDL	0.010	BMDL	0.010	BMDL	0.010	ND	2
Thallium	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	2
Zinc	0.360	0.020	0.230	0.020	0.058	0.020	1.600	0.020	0.580	0.020	0.350	0.020	487	20
Cyanide	ND	0.025	ND	0.025	ND	0.025	ND	0.025	ND	0.025	ND	0.025	ND	1

CONC. - Concentration of compound

D.L. - Detection Limit

ND - Not detected

BMDL - Present below method detection limit, estimated concentration not reported by laboratory

TABLE 5-8  
SUMMARY OF SEDIMENT ANALYTICAL DATA  
VOLATILES AND SEMIVOLATILES  
SCCC, KIARNEY, NJ

LAB NUMBER SAMPLE NUMBER	HA3579 S-1		HA3581 SSW-1		HA3580 S-2		HA3577 SSW-2		HA3578 SSW-3		HA3576 SSW-4		HA3582 SSW-5		CB-2174 SSW-6	
	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.
VOC Compound (ug/kg)																
Benzene	ND	16	14.9	13	58.4	58	BMDL	16	ND	8100	ND	18000	ND	1500	5 J	65
Chlorobenzene	ND	21	1484	18	1950	79	38.5	21	42100	11000	140000	24000	9640	2000	870	65
Methylene chloride	ND	10	13.6	8.2	61.1	37	ND	10	BMDL	5200	15000	11000	1360	930	23 J	65
Toluene	ND	21	ND	18	BMDL	79	ND	21	ND	11000	ND	24000	ND	2000	11 J	65
Ethylbenzene	ND	26	ND	21	ND	95	ND	26	ND	13000	ND	29000	ND	2400	45 J	65
Xylenes	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	49 J	65
BNA Compound (ug/kg)																
Acenaphthene	ND	680	ND	5600	ND	2500	BMDL	680	7860	7000	BMDL	7600	BMDL	13000	2300	430
Anthracene	ND	680	ND	5600	ND	2500	ND	680	BMDL	7000	ND	7600	ND	13000	500	430
Benzo(a)anthracene	ND	2800	ND	23000	ND	10000	BMDL	2800	BMDL	29000	BMDL	31000	ND	52000	1100	430
Benzo(a)pyrene	ND	890	ND	7300	ND	3300	ND	890	37700	9200	27900	10000	ND	17000	1200	430
Benzo(b)fluoranthene	ND	1700	ND	14000	ND	6300	ND	1700	37700	18000	44600	19000	ND	32000	2400	430
Benzo(g,h,i)perylene	ND	1500	ND	12000	ND	5300	ND	1500	36200	15000	23900	16000	ND	27000	1200	430
Bis(2-ethylhexyl)phthalate	17800	3600	BMDL	29000	ND	13000	ND	3600	ND	37000	65500	40000	188000	67000	ND	430
Carbazole	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	220 J	430
Chrysene	ND	890	ND	7300	ND	3300	1100	890	28000	9200	33600	10000	ND	17000	1200	430
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1000	430
Di-n-Butylphthalate	ND	8600	ND	29000	ND	13000	ND	3600	ND	37000	ND	40000	ND	67000	170 J	430
1,2-Dichlorobenzene	BMDL	680	ND	5600	125000	2500	ND	680	723000	7000	1070000	7600	13300	13000	1100	430
1,3-Dichlorobenzene	1470	680	ND	5600	109000	2500	ND	680	593000	7000	1010000	7600	35200	13000	800	430
1,4-Dichlorobenzene	2090	1600	ND	13000	202000	5700	ND	1600	637000	16000	1170000	18000	48500	29000	1900	430
Fluoranthene	BMDL	780	ND	6400	BMDL	2900	3950	780	31500	8100	487000	8800	BMDL	15000	2100	430
Fluorene	ND	680	ND	5600	ND	2500	ND	680	BMDL	7000	ND	7600	ND	13000	1000	430
Indeno(1,2,3-cd)pyrene	ND	1300	ND	11000	ND	4800	ND	1300	48300	14000	27800	15000	ND	25000	1500	430
2-Methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	430
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1600	430
Naphthalene	ND	570	ND	4700	ND	2100	879	570	234000	5900	8800	6400	ND	11000	3400	430
Phenanthrene	BMDL	1900	ND	16000	BMDL	7000	4880	1900	23500	20000	47400	22000	ND	36000	1800	430
Pyrene	BMDL	680	ND	5600	BMDL	2500	3350	680	28500	7000	41800	7600	ND	13000	1700	430
1,2,4-Trichlorobenzene	776	680	ND	5600	60200	2500	ND	680	190000	7000	257000	7600	ND	13000	590	430
2,4-Dimethylphenol	ND	960	ND	7900	ND	3500	ND	960	ND	10000	ND	11000	ND	18000	ND	430
Phenol	ND	530	ND	4400	ND	2000	ND	530	ND	5000	ND	6000	ND	10000	ND	430
Phenolics	ND	0.57	ND	0.47	ND	0.21	ND	0.57	ND	0.59	0.69	0.64	ND	1.10	NA	NA

CONC. - Concentration of compound

D.L. - Detection Limit

NA - Not analyzed

ND - Not detected

J - Estimated concentration of compound detected below the detection limit

B - Compound also found in laboratory blank

BMDL - Present below method detection limit, estimated concentration not reported by laboratory.

TABLE 5-8 (Continued)  
SUMMARY OF SEDIMENT ANALYTICAL DATA  
METALS  
SCCC, KEARNY, NJ

LAB NUMBER SAMPLE NUMBER	HA3579 S-1		HA3581 SSW-1		HA3580 S-2		HA3577 SSW-2		HA3578 SSW-3		HA3576 SSW-4		HA3582 SSW-5		CB-2174 SSW-6	
	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.	CONC.	D.L.
Metals (ug/kg)																
Antimony	26.00	21.00	100.00	17.00	BMDL	7.90	40.00	21.00	130.0	22.00	91.00	24.00	120.0	41.00	20.7	24
Arsenic	5.20	3.60	11.00	2.90	8.40	1.30	BMDL	3.60	14.0	3.70	20.00	4.00	21.0	6.90	29.6	4
Beryllium	BMDL	0.36	0.78	0.29	0.25	0.13	0.51	0.36	1.4	0.37	ND	0.40	1.5	0.69	ND	0.4
Cadmium	2.10	0.71	4.80	0.58	1.80	0.26	4.50	0.71	8.1	0.75	BMDL	0.81	12.0	1.40	6.82	0.8
Chromium	3440.00	3.60	12700.00	2.90	100.00	1.30	5560.00	3.60	16400.0	3.70	930.00	4.00	12600.0	6.90	1090	4
Copper	40.00	3.60	73.00	2.90	66.00	1.30	25.00	3.60	170.0	3.70	220.00	4.00	250.0	6.90	401	4
Lead	51.00	27.00	140.00	22.00	390.00	9.90	70.00	27.00	1200.0	28.00	15500.00	30.00	5300.0	52.00	156	30
Mercury	0.83	0.29	1.30	0.23	0.19	0.11	1.20	0.29	1.2	0.30	0.98	0.32	3.6	0.55	24.5	0.32
Nickel	14.00	7.10	99.00	5.80	24.00	2.60	65.00	7.10	190.0	7.50	49.00	8.10	110.0	14.00	718	8.1
Selenium	BMDL	1.80	ND	1.50	BMDL	0.66	ND	1.80	ND	5.90	BMDL	2.00	BMDL	3.40	ND	2
Silver	BMDL	3.60	4.20	2.90	ND	1.30	5.10	3.60	6.0	3.70	ND	4.00	BMDL	6.90	BMDL	4
Thallium	ND	3.60	ND	2.90	ND	1.30	ND	3.60	ND	3.70	ND	4.00	ND	6.90	ND	4
Zinc	98.00	7.10	290.00	5.80	738.00	2.60	170.00	7.10	640.0	7.50	120.00	8.10	1850.0	14.00	298	8.1
Cyanide	ND	1.80	ND	1.50	ND	0.66	3.86	1.80	5.48	1.80	ND	2.00	10.33	3.30	1.5	1

CONC. - Concentration of compound

D.L. - Detection Limit

ND - Not detected

BMDL - Present below method detection limit, estimated concentration not reported by laboratory



**1996-1997 Focused Remedial Investigation  
Surface Water/Sediment**

Table 3-4

## Summary of FRI Sediment Sample Results

Standard Chlorine Chemical Company

Kearny, New Jersey Facility

Sample ID		SED-B1	SED-B2	SED-B3	SED-A1	SED-A4	SED-A2	SED-A3	SED-C1
Lab ID#	Sediment								
Sample Date	Screening Guidelines*†	BRI933	BRI934	BRI935	BRI936	BRI937	BRI938	BRI939	BRI940
Matrix		08/28/96	8/29/96	8/29/96	8/29/96	08/28/96	08/28/96	08/28/96	08/28/96
Units	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Parameter	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
VOC's (µg/kg)									
1,2,3-Trichlorobenzene	-						11.1 BMDL	18.7	
1,2,4-Trichlorobenzene	-						40.5	61.1	
1,2,4-Trimethylbenzene	-						4.51 BMDL	40.4	
1,2-Dichlorobenzene	35*	4.78 BMDL	1.95 BMDL		4.19 BMDL	7.67 BMDL	160	164	
1,3-Dichlorobenzene	-	4.45 BMDL	1.62 BMDL		18.7	31.5	145	69.6	9.11
1,4-Dichlorobenzene	110*	10.80 BMDL	3.73 BMDL	2.03 BMDL	45.4	79.1	212	160	6.17 BMDL
Benzene	-							4.68 BMDL	
Butylbenzene	-						6.52 BMDL		
Chlorobenzene	-						33.6	11.2 BMDL	
Cumene	-						5.52 BMDL	17.3	
Ethylbenzene	10*							15.7	
Methylene chloride	-				6.83 BMDL		9.3 BMDL	9.9 BMDL	8.71
Toluene	-							7.64 BMDL	
m+p-Xylenes	40*							7.79 BMDL	
p-Cymene	-						7.91 BMDL	42.8	
SVOC's (µg/kg)									
sec-Butylbenzene	-						1.84 BMDL		
Naphthalene	340/2100†	3.57 BMDL	6.88 BMDL	0.744 BMDL	2.58 BMDL	4.62 BMDL	33.5	367	

Notes:

ND = Not detected.

BMDL = Concentration detected below method detection limit

Shaded values are above the sediment standard listed.

\* - Standard obtained from the Region III BTAG Screening Levels chart (8-9-95)

† - Standard obtained from the National Oceanic and Atmospheric Administration Technical Memorandum NOS OMA 52 (ER-L/ER-M Concentration)

Table 3-5

## Summary of Sediment Sample Results Collected for Maxus Property Investigation

Standard Chlorine Chemical Company

Kearny, New Jersey Facility

Sample ID	Sediment	SED-126A	SED-126B	SED-126C
Lab ID#	Screening Guidelines*†			
Sample Date		9/23/92	9/23/92	9/23/92
Matrix		Sediment	Sediment	Sediment
Units		µg/kg	µg/kg	µg/kg
Parameter				
<b>VOC's</b>				
1,3-Dichlorobenzene	-	650		290,000
1,4-Dichlorobenzene	110*	1,000		360,000
1,2-Dichlorobenzene	35*			280,000
1,2,4-Trichlorobenzene	-	270		1,200,000
<b>SVOC's</b>				
Naphthalene	340/2100†	480	7,600	170,000
2-Methyl-naphthalene	-		5,400	
Acenaphthylene	44*		2,000	
Acenaphthene	16*		7,100	
Phenanthrene	225/1380†	620	43,000	
Anthracene	85/960†		21,000	
Fluoranthene	-	2,500	35,000	
Pyrene	350/2200†	2,200	46,000	
Benzo(a)-anthracene	230/1600†	1,500	26,000	
bis(2-Ethylhexyl)-phthalate	-	10,000	15,000	
Chrysene	-	1,300		
Benzo(b)-fluoranthene	-	1,800	19,000	
Benzo(k)-fluoranthene	-	810		
Benzo(a)-pyrene	400/2500†	1,400	17,000	
Indeno(1,2,3-cd)-pyrene	-	540	56,000	
Benzo(g,h,i)-perylene	-	480	4,900	
1,1,1-Trichloroethane	-			3,900
Benzene	-		410	
Chlorobenzene	-		120,000	
<b>Pesticides/PCBs</b>				
4,4-DDE	2.2	22		
4,4'-DDD	16	14		
gamma-Chlordane	-	5		
Aroclor-1254	-	210		

## Notes:

ND = Not detected.

BMDL = Concentration detected below method detection limit.

Values that are in bold italics and shaded are above the listed guideline.

\* - Standard obtained from the Region III BTAG Screening Levels chart (8-9-95)

† - Standard obtained from the National Oceanic and Atmospheric Administration

Technical Memorandum NOS OMA 52 (ER-L/ER-M Concentration).

**Table 3-6**

**Summary of FRI Surface Water Sample Results**

Standard Chlorine Chemical Company

Kearny, New Jersey Facility

Sample ID	NJDEP Surface Water Quality Standards "SE" Classification	EB-1	SW-3	SW-2	TB-1	SW-1	SW-4
Lab ID#		BRI941	BRI942	BRI943	BRI945	BRI947	BRI948
Sample Date		08/28/96	08/28/96	08/28/96	08/28/96	08/28/96	08/28/96
Matrix	Surface Water	Water	Water	Water	Water	Water	Water
Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Parameter							
VOC's							
1,2,4-Trichlorobenzene	123						1.63 BMDL
1,2-Dichlorobenzene	16,500		6.13	1.43 BMDL		1.57 BMDL	3.14 BMDL
1,3-Dichlorobenzene	22,000		4.56 BMDL				
1,4-Dichlorobenzene	3,139		6.37	1.21 BMDL		1.47 BMDL	1.8 BMDL
Chlorobenzene	21,000		2.52 BMDL				
SVOC's							
Naphthalene	NA						3.15 BMDL

Notes:

BMDL = Concentration detected below  
method detection limit.

NA = No standard available.

**2000 Remedial Action Workplan  
Sediment/Surface Water**

TABLE 1

**SUMMARY OF SEDIMENT ANALYTICAL RESULTS**  
**COLLECTED JANUARY 17, 2000 - JANUARY 19, 2000**  
**STANDARD CHLORINE**  
**KEARNY, NEW JERSEY**

ft bgs - feet below ground surface

NLE - No Level Established

MDL - Method Detection Limit

ppm - parts per million

Q - Qualifier

D - Diluted

ND - Not Detected

J - Concentration detected below MDL

**Enviro-Sciences, Inc.**

Sample ID Number	RESIDENTIAL	NON-RESIDENTIAL	Impact to	TPS-A1-1	TPS-A1-5	TPS-A1-10
Laboratory Sample Number:	Direct Contact	Direct Contact	Groundwater	310-001	361-001	361-002
Depth Collected (ft bgs)	Soil Cleanup	Soil Cleanup	Soil Cleanup	1.0	5.0	10.0
Date Sampled:	Criteria	Criteria	Criteria	01/17/00	01/19/00	01/19/00
				MDL CONC Q	MDL CONC Q	MDL CONC Q
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Dilution Factor	--	--	--			
<b>VO+10</b>						
Benzene	3	13	1	ND	ND	0.741
Trichloroethene	23	54	1	ND	ND	2.75
Tetrachloroethene	4	6	1	ND	ND	1.98
1,3-Dichlorobenzene	5100	10000	100	ND	ND	29.7
1,4-Dichlorobenzene	280	1200	1200	ND	ND	26.4
1,2-Dichlorobenzene	5100	10000	50	ND	ND	13.4
Chlorobenzene	37	680	1	ND	ND	5.17
TOTAL TARGETED VOs:	---	---	---	ND	ND	80.14
TOTAL NON-TARGETED VOs:	---	---	---	98	3.59	5.32
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Dilution Factor	--	--	--			
<b>BN+15</b>						
Acenaphthene	3400	10000	100	ND	ND	ND
Acenaphthylene	NLE	NLE	NLE	ND	ND	ND
Anthracene	10000	10000	100	ND	ND	ND
Benzo(a)anthracene	0.90	4	500	0.77 J	ND	ND
Benzo(a)pyrene	0.66	0.66	100	ND	ND	ND
Benzo(b)fluoranthene	0.90	4.00	50	ND	ND	ND
Benzo(g,h,i)perylene	NLE	NLE	NLE	ND	ND	ND
Benzo(k)fluoranthene	0.90	4.00	100	ND	ND	ND
Bis(2-ethylhexyl)phthalate	49	210	100	ND	ND	ND
Benzedrine	NLE	NLE	NLE	ND	ND	ND
Chrysene	9	40	500	ND	ND	ND
Dibenzofuran	NLE	NLE	NLE	ND	ND	ND
Dibenzo(a,h)anthracene	0.66	0.66	100	ND	ND	ND
Fluoranthene	2300	10000	100	1.01 J	ND	ND
Fluorene	2300	10000	100	ND	ND	ND
Indeno(1,2,3-cd)pyrene	0.90	4	500	ND	ND	ND
2-Methylnaphthalene	NLE	NLE	NLE	ND	ND	ND
Naphthalene	230	4200	100	200	0.323 J	ND
Phenanthrene	NLE	NLE	NLE	ND	ND	ND
Pyrene	1700	10000	100	1.01 J	ND	ND
1,2,4-Trichlorobenzene	69	1200	100	ND	1.1	0.183
1,3-Dichlorobenzene	5100	10000	100	ND	ND	0.729
1,4-Dichlorobenzene	570	10000	100	ND	ND	0.741
1,2-Dichlorobenzene	5100	10000	50	ND	ND	0.137
TOTAL TARGETED BNs:	--	--	--	202.79	1.423	1.79
TOTAL NON-TARGETED BNs:	--	--	--	ND	ND	316.22
Dioxin	--	--	--	ND	ND	ND
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Dilution Factor	--	--	--			
<b>Priority Pollutant Metals</b>						
Arsenic	20	20	NLE	19.5	0.443	1.97
Beryllium	1	1	NLE	0.3	ND	ND
Cadmium	1	1	NLE	0.9	ND	ND
Chromium	120000	NLE	NLE	3,207	9.5	24.7
Chromium, (hexvalent)	NLE	NLE	NLE	ND	ND	ND
Copper	600	600	NLE	45.4	29.9	6.48
Lead	400	600	NLE	131	2.84	ND
Mercury	14	270	NLE	0.4	ND	ND
Nickel	250	2400	NLE	208	2.68	5.34
Silver	110	4100	NLE	ND	ND	ND
Thallium	2	2	NLE	ND	ND	0.091
Zinc	1500	1500	NLE	288	15.8	10
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Total Organic Carbon	--	--	--	20,000	61,000	1,800

TABLE 1

**SUMMARY OF SEDIMENT ANALYTICAL RESULTS**  
**COLLECTED JANUARY 17, 2000 - JANUARY 19, 2000**  
**STANDARD CHLORINE**  
**KEARNY, NEW JERSEY**

ft bgs - feet below ground surface

NLE - No Level Established

MDL - Method Detection Limit

ppm - parts per million

Q - Qualifier

D - Diluted

ND - Not Detected

J - Concentration detected below MDL

**Enviro-Sciences, Inc.**

Sample ID Number	RESIDENTIAL	NON-RESIDENTIAL	Impact to	TPS-A2-1	TPS-A2-5	TPS-A2-10
Laboratory Sample Number:	Direct Contact	Direct Contact	Groundwater	310-002	310-003	364-003
Depth Collected (ft bgs)	Soil Cleanup	Soil Cleanup	Soil Cleanup	1.0	5.0	10.0
Date Sampled:	Criteria	Criteria	Criteria	01/17/00	01/17/00	01/19/00
				MDL CONC Q	MDL CONC Q	MDL CONC Q
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Dilution Factor	--	--				
<b>VO+10</b>						
Benzene	3	13	1	ND	ND	4.58 J
Trichloroethene	23	54	1	ND	ND	85.7
Tetrachloroethene	4	6	1	ND	ND	123
1,3-Dichlorobenzene	5100	10000	100	ND	ND	103
1,4-Dichlorobenzene	280	1200	100	ND	ND	759 D
1,2-Dichlorobenzene	5100	10000	50	ND	ND	766 D
Chlorobenzene	37	680	1	ND	ND	1,460 D
TOTAL TARGETED VOs:	---	---	---	ND	ND	3,301
TOTAL NON-TARGETED VOs:	---	---	---	13	ND	105.94

COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Dilution Factor	--	--				
<b>BN+15</b>						
Acenaphthene	3400	10000	100	ND	ND	ND
Acenaphthylene	NLE	NLE	NLE	ND	ND	ND
Anthracene	10000	10000	100	0.16 J	ND	ND
Benzo(a)anthracene	0.90	4	500	0.66	ND	ND
Benzo(a)pyrene	0.66	0.66	100	0.54	ND	ND
Benzo(b)fluoranthene	0.90	4.00	50	0.72	ND	ND
Benzo(g,h,i)perylene	NLE	NLE	NLE	0.40	ND	ND
Benzo(k)fluoranthene	0.90	4.00	100	0.28	ND	ND
Bis(2-ethylhexyl)phthalate	49	210	100	ND	ND	ND
Benzedrine	NLE	NLE	NLE	ND	ND	ND
Chrysene	9	40	500	0.53	ND	ND
Dibenzofuran	NLE	NLE	NLE	ND	ND	ND
Dibenzo(a,h)anthracene	0.66	0.66	100	ND	ND	ND
Fluoranthene	2300	10000	100	1.14	ND	ND
Fluorene	2300	10000	100	ND	ND	ND
Indeno(1,2,3-cd)pyrene	0.90	4	500	0.36	ND	ND
2-Methylnaphthalene	NLE	NLE	NLE	ND	ND	0.58 J
Naphthalene	230	4200	100	0.48	ND	40.90
Phenanthrene	NLE	NLE	NLE	0.44	ND	ND
Pyrene	1700	10000	100	0.97	ND	ND
1,2,4-Trichlorobenzene	69	1200	100	ND	ND	43.20
1,3-Dichlorobenzene	5100	10000	100	ND	ND	0.98
1,4-Dichlorobenzene	570	10000	100	ND	ND	1.10
1,2-Dichlorobenzene	5100	10000	50	ND	ND	3.72
TOTAL TARGETED BNs:	--	--	--	6.67	ND	90.48
TOTAL NON-TARGETED BNs:	--	--	--	ND	93.3	286.60
Dioxin	--	--	--	ND	ND	ND

COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Dilution Factor	--	--				
<b>Priority Pollutant Metals</b>						
Arsenic	20	20	NLE	8.8	76.4	1.9
Beryllium	1	1	NLE	ND	ND	ND
Cadmium	1	1	NLE	0.6	1.7	ND
Chromium	120000	NLE	NLE	3,197	930	38.7
Chromium, (hexavalent)	NLE	NLE	NLE	ND	73.1	3.81
Copper	600	600	NLE	17.4	199	10.7
Lead	400	600	NLE	81.4	236	3.9
Mercury	14	270	NLE	0.2	1.3	ND
Nickel	250	2400	NLE	173	107	8.8
Silver	110	4100	NLE	ND	ND	ND
Thallium	2	2	NLE	ND	ND	0.2
Zinc	1500	1500	NLE	193	411	21.1

COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Total Organic Carbon	--	--	--	25,000	49,000	4,300

TABLE 1

**SUMMARY OF SEDIMENT ANALYTICAL RESULTS**  
**COLLECTED JANUARY 17, 2000 - JANUARY 19, 2000**  
**STANDARD CHLORINE**  
**KEARNY, NEW JERSEY**

ft bgs - feet below ground surface

NLE - No Level Established

MDL - Method Detection Limit

ppm - parts per million

Q - Qualifier

D - Diluted

ND - Not Detected

J - Concentration detected below MDL

**Enviro-Sciences, Inc.**

Sample ID Number	RESIDENTIAL	NON-RESIDENTIAL	Impact to	TPS-A3-1	TPS-A3-5	TPS-A3-10
Laboratory Sample Number:	Direct Contact	Direct Contact	Groundwater	310-004	310-005	364-005
Depth Collected (ft bgs)	Soil Cleanup	Soil Cleanup	Soil Cleanup	1.0	5.0	10.0
Date Sampled:	Criteria	Criteria	Criteria	01/17/00	01/17/00	01/19/00
				MDL CONC Q	MDL CONC Q	MDL CONC Q
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Dilution Factor	--	--	--			
<b>10+10</b>						
Benzene	3	13	1	ND	ND	ND
Trichloroethene	23	54	1	ND	ND	0.32 J
Tetrachloroethene	4	6	1	ND	ND	ND
1,3-Dichlorobenzene	5100	10000	100	ND	ND	0.84
1,4-Dichlorobenzene	280	1200	100	ND	ND	0.86
1,2-Dichlorobenzene	5100	10000	50	ND	ND	2.23
Chlorobenzene	37	680	1	6.26 J	ND	ND
TOTAL TARGETED VOs:	---	---	---	6.26	ND	4.26
TOTAL NON-TARGETED VOs:	---	---	---	1.5	ND	36.59

COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Dilution Factor	--	--	--			
<b>3N+15</b>						
Acenaphthene	3400	10000	100	0.25 J	ND	ND
Acenaphthylene	NLE	NLE	NLE	2.22	0.33 J	ND
Anthracene	10000	10000	100	4.85	0.30	ND
Benzo(a)anthracene	0.90	4	500	15	1.06	ND
Benzo(a)pyrene	0.66	0.66	100	13.20	1.10	ND
Benzo(b)fluoranthene	0.90	4.00	50	16.30	1.07	ND
Benzo(g,h,i)perylene	NLE	NLE	NLE	4.50	0.67	ND
Benzo(k)fluoranthene	0.90	4.00	100	6.65	0.33 J	ND
Bis(2-ethylhexyl)phthalate	49	210	100	5.01	ND	ND
Benzedrine	NLE	NLE	NLE	ND	ND	ND
Chrysene	9	40	500	11.20	0.56	ND
Dibenzofuran	NLE	NLE	NLE	ND	ND	ND
Dibenzo(a,h)anthracene	0.66	0.66	100	1.77	ND	ND
Fluoranthene	2300	10000	100	41.20	1.29	ND
Fluorene	2300	10000	100	0.61	ND	ND
Indeno(1,2,3-cd)pyrene	0.90	4	500	4.91	0.55	ND
2-Methylnaphthalene	NLE	NLE	NLE	ND	ND	ND
Naphthalene	230	4200	100	0.64	0.34 J	0.29
Phenanthrene	NLE	NLE	NLE	4.32	0.85	ND
Pyrene	1700	10000	100	26.90	1.81	ND
1,2,4-Trichlorobenzene	69	1200	100	ND	ND	2.97
1,3-Dichlorobenzene	5100	10000	100	0.38	ND	0.24
1,4-Dichlorobenzene	570	10000	100	0.42	ND	0.29
1,2-Dichlorobenzene	5100	10000	50	0.64	ND	0.55
TOTAL TARGETED BNs:	---	---	---	160.97	10.25	4.33
TOTAL NON-TARGETED BNs:	---	---	---	60.63	37.85	0.58
Dioxin	---	---	---	ND	ND	ND

COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Dilution Factor	--	--	--			
<b>Priority Pollutant Metals</b>						
Arsenic	20	20	NLE	31.4	112	2.03
Beryllium	1	1	NLE	0.6	0.8	0.404
Cadmium	1	1	NLE	2.4	1.5	ND
Chromium	120000	NLE	NLE	1,280	257	14.3
Chromium, (hexavalent)	NLE	NLE	NLE	ND	4.29	ND
Copper	600	600	NLE	150	317	13.8
Lead	400	600	NLE	178	339	11.7
Manganese	14	270	NLE	4.4	6.4	ND
Mercury	250	2400	NLE	68.4	62.3	22
Silver	110	4100	NLE	1.7	2.2	ND
Thallium	2	2	NLE	ND	ND	0.104
Zinc	1500	1500	NLE	362	388	55

COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Total Organic Carbon	---	---	---	22,000	19,000	2,300



TABLE 1

**SUMMARY OF SEDIMENT ANALYTICAL RESULTS**  
**COLLECTED JANUARY 17, 2000 - JANUARY 19, 2000**  
**STANDARD CHLORINE**  
**RNY, NEW JERSEY**

ft bgs - feet below ground surface

NLE - No Level Established

MDL - Method Detection Limit

ppm - parts per million

Q - Qualifier

D - Diluted

ND - Not Detected

J - Concentration detected below MDL

Enviro-Sciences, Inc.

Sample ID Number	RESIDENTIAL	NON-RESIDENTIAL	Impact to	TPS-B1-1	TPS-B1-5	TPS-B1-10
Laboratory Sample Number:	Direct Contact	Direct Contact	Groundwater	310-006	310-007	318-001
Depth Collected (ft bgs)	Soil Cleanup	Soil Cleanup	Soil Cleanup	1.0	5.0	10.0
Date Sampled:	Criteria	Criteria	Criteria	01/17/00	01/17/00	01/18/00
				MDL CONC Q	MDL CONC Q	MDL CONC Q
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Dilution Factor	--	--				
<b>VO+10</b>						
Toluene	1000	1000	50	ND	ND	0.22 J
Chlorobenzene	37	680	1	ND	ND	ND
TOTAL TARGETED VO's:	---	---	---	ND	ND	0.22
TOTAL NON-TARGETED VO's:	---	---	---	1,880	4	ND

COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Dilution Factor	--	--				
<b>BN+15</b>						
Acenaphthene	3400	10000	100	ND	ND	ND
Acenaphthylene	NLE	NLE	NLE	ND	ND	ND
Anthracene	10000	10000	100	ND	ND	ND
Benzo(a)anthracene	0.90	4	500	0.76	ND	ND
Benzo(a)pyrene	0.66	0.66	100	1.07	ND	ND
Benzo(b)fluoranthene	0.90	4	50	2.67	ND	ND
Benzo(g,h,i)perylene	NLE	NLE	NLE	0.63	ND	ND
Benzo(k)fluoranthene	0.90	4	500	1.93	ND	ND
Bis(2-ethylhexyl)phthalate	49	210	100	0.33 J	ND	0.51
Indene	NLE	NLE	NLE	ND	ND	ND
Fluorene	9	40	500	0.60	ND	ND
Limonofuran	NLE	NLE	NLE	ND	ND	ND
Dibenzo(a,h)anthracene	0.66	0.66	100	ND	ND	ND
Fluoranthene	2300	10000	100	1.28	ND	ND
Fluorene	2300	10000	50	ND	ND	ND
Indeno(1,2,3-cd)pyrene	0.90	4	4	0.44 J	ND	ND
2-Methylnaphthalene	NLE	NLE	NLE	ND	ND	ND
Naphthalene	230	4200	100	4,570 D	26.3	ND
Phenanthrene	NLE	NLE	NLE	0.49 J	ND	ND
Pyrene	1700	10000	100	0.89	ND	ND
1,3-Dichlorobenzene	5100	10000	100	ND	ND	ND
1,4-Dichlorobenzene	570	10000	100	ND	ND	ND
1,2-Dichlorobenzene	5100	10000	50	ND	ND	ND
TOTAL TARGETED BN's:	--	--	--	4,581.09	26.3	0.51
TOTAL NON-TARGETED BN's:	--	--	--	ND	13.48	124.65
Dioxin	--	--	--	ND	ND	ND

COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Dilution Factor	--	--				
<b>Priority Pollutant Metals</b>						
Arsenic	20	20	NLE	7.91	6.21	0.28
Beryllium	1	1	NLE	2	ND	ND
Cadmium	1	1	NLE	1.27	ND	ND
Chromium	120000	NLE	NLE	1,079	143	6.59
Chromium, (hexavalent)	NLE	NLE	NLE	ND	ND	ND
Copper	600	600	NLE	37	ND	1.44
Lead	400	600	NLE	51.6	ND	3.46
Mercury	14	270	NLE	0.098	0.159	0.03
Nickel	250	2400	NLE	50.6	8.07	2.49
Silver	110	4100	NLE	ND	ND	ND
Thallium	2	2	NLE	ND	ND	ND
Zinc	1500	1500	NLE	162	37.6	3.84

COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Total Organic Carbon	--	--	--	58,000	71,000	45,000

TABLE 1

**SUMMARY OF SEDIMENT ANALYTICAL RESULTS**  
**COLLECTED JANUARY 17, 2000 - JANUARY 19, 2000**  
**STANDARD CHLORINE**  
**ENVIRONMENTAL**  
**NEW JERSEY**

ft bgs - feet below ground surface

NLE - No Level Established

MDL - Method Detection Limit

ppm - parts per million

Q - Qualifier

D - Diluted

ND - Not Detected

J - Concentration detected below MDL

Enviro-Sciences, Inc.

Sample ID Number	RESIDENTIAL	NON-RESIDENTIAL	Impact to	TPS-B2-1	TPS-B2-5	TPS-B2-10
Laboratory Sample Number:	Direct Contact	Direct Contact	Groundwater	318-002	318-003	318-009
Depth Collected (ft bgs)	Soil Cleanup	Soil Cleanup	Soil Cleanup	1.0	5.0	10.0
Date Sampled:	Criteria	Criteria	Criteria	01/18/00	01/18/00	01/18/00
				MDL CONC Q	MDL CONC Q	MDL CONC Q
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Dilution Factor	--	--				
VO+10						
Toluene	1000	1000	50	ND	ND	ND
Chlorobenzene	37	680	1	ND	ND	ND
TOTAL TARGETED VOs:	---	---	---	ND	ND	ND
TOTAL NON-TARGETED VOs:	---	---	---	ND	1	98

COMPOUNDS (units)	(ppm)	(ppm)		(ppm)	(ppm)	(ppm)
Dilution Factor	--	--				
BN+15						
Acenaphthene	3400	10000	100	ND	ND	1.10
Acenaphthylene	NLE	NLE	NLE	ND	ND	ND
Anthracene	10000	10000	100	ND	ND	ND
Benzo(a)anthracene	0.90	4	500	0.66	ND	ND
Benzo(a)pyrene	0.66	0.66	100	0.61	ND	ND
Benzo(b)fluoranthene	0.90	4	50	1.14	ND	ND
Benzo(g,h,i)perylene	NLE	NLE	NLE	0.22	J	ND
Benzo(k)fluoranthene	0.90	4	500	0.63	ND	ND
Bis(2-ethylhexyl)phthalate	49	210	100	0.96	ND	ND
Benzo(e)pyrene	NLE	NLE	NLE	ND	ND	0.32
Benzo(f)pyrene	9	40	500	0.34	ND	ND
Dibenzofuran	NLE	NLE	NLE	ND	ND	0.68
Dibenzo(a,h)anthracene	0.66	0.66	100	ND	ND	ND
Fluoranthene	2300	10000	100	0.79	ND	ND
Fluorene	2300	10000	50	ND	ND	0.28
Indeno(1,2,3-cd)pyrene	0.90	4	4	0.21	J	ND
2-Methylnaphthalene	NLE	NLE	NLE	ND	ND	4.80
Naphthalene	230	4200	100	0.73	ND	2.57
Phenanthrene	NLE	NLE	NLE	ND	ND	0.19
Pyrene	1700	10000	100	0.56	ND	ND
1,3-Dichlorobenzene	5100	10000	100	ND	ND	0.22
1,4-Dichlorobenzene	570	10000	100	ND	ND	0.47
1,2-Dichlorobenzene	5100	10000	50	ND	ND	0.29
TOTAL TARGETED BNs:	--	--	--	6.84	ND	10.92
TOTAL NON-TARGETED BNs:	--	--	--	ND	17.19	959.39
Dioxin	--	--	--	ND	ND	ND

COMPOUNDS (units)	(ppm)	(ppm)		(ppm)	(ppm)	(ppm)
Dilution Factor	--	--				
Priority Pollutant Metals						
Arsenic	20	20	NLE	38.90	0.78	1.38
Beryllium	1	1	NLE	0.62	0.43	ND
Cadmium	1	1	NLE	1.30	ND	ND
Chromium	120000	NLE	NLE	5,240	34.20	12.8
Chromium, (hexavalent)	NLE	NLE	NLE	ND	ND	ND
Copper	600	600	NLE	110	4.78	15
Lead	400	600	NLE	192	7.84	4.27
Mercury	14	270	NLE	6.50	0.10	ND
Nickel	250	2400	NLE	308	7.30	2.06
Silver	110	4100	NLE	0.86	ND	ND
Thallium	2	2	NLE	0.29	ND	ND
Zinc	1500	1500	NLE	420	11.70	3.6

COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Total Organic Carbon	--	--	--	11,000	18,000	ND

TABLE 1

SUMMARY OF SEDIMENT ANALYTICAL RESULTS  
COLLECTED JANUARY 17, 2000 - JANUARY 19, 2000  
STANDARD CHLORINE  
ARMY, NEW JERSEY

ft bgs - feet below ground surface

NLE - No Level Established

MDL - Method Detection Limit

ppm - parts per million

Q - Qualifier

D - Diluted

ND - Not Detected

J - Concentration detected below MDL

## Enviro-Sciences, Inc.

Sample ID Number	RESIDENTIAL	NON-RESIDENTIAL	Impact to	TPS-B3-1	TPS-B3-5	TPS-B3-10
Laboratory Sample Number:	Direct Contact	Direct Contact	Groundwater	310-008	310-009	364-005
Depth Collected (ft bgs)	Soil Cleanup	Soil Cleanup	Soil Cleanup	1.0	5.0	10.0
Date Sampled:	Criteria	Criteria	Criteria	01/17/00	01/17/00	01/19/00
				MDL CONC Q	MDL CONC Q	MDL CONC Q
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Dilution Factor	--	--				
VO+10						
Toluene	1000	1000	50	0.38 J	ND	ND
Chlorobenzene	37	680	1	0.69 J	ND	ND
TOTAL TARGETED VOs:	---	---	---	1.07	ND	ND
TOTAL NON-TARGETED VOs:	---	---	---	ND	ND	ND

COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Dilution Factor	--	--				
BN+15						
Acenaphthene	3400	10000	100	0.75	ND	ND
Acenaphthylene	NLE	NLE	NLE	0.82	ND	ND
Anthracene	10000	10000	100	1.98	ND	ND
Benzo(a)anthracene	0.90	4	500	4.31	ND	ND
Benzo(a)pyrene	0.66	0.66	100	2.79	ND	ND
Benzo(b)fluoranthene	0.90	4	50	2.76	ND	ND
Benzo(g,h,i)perylene	NLE	NLE	NLE	1.36	ND	ND
Benzo(k)fluoranthene	0.90	4	500	1.13	ND	ND
Bis(2-ethylhexyl)phthalate	49	210	100	0.78	ND	ND
zidine	NLE	NLE	NLE	ND	ND	ND
ysene	9	40	500	2.97	ND	ND
Dibenzofuran	NLE	NLE	NLE	ND	ND	ND
Dibenzo(a,h)anthracene	0.66	0.66	100	0.88	ND	ND
Fluoranthene	2300	10000	100	4.41	ND	ND
Fluorene	2300	10000	50	0.51	ND	ND
Indeno(1,2,3-cd)pyrene	0.90	4	4	1.38	ND	ND
2-Methylnaphthalene	NLE	NLE	NLE	0.35 J	ND	ND
Naphthalene	230	4200	100	3.94	0.13	ND
Phenanthrene	NLE	NLE	NLE	2.25	ND	ND
Pyrene	1700	10000	100	5.26	ND	ND
1,3-Dichlorobenzene	5100	10000	100	ND	ND	ND
1,4-Dichlorobenzene	570	10000	100	ND	ND	ND
1,2-Dichlorobenzene	5100	10000	50	ND	ND	ND
TOTAL TARGETED BNs:	--	--	--	38.62	0.13	ND
TOTAL NON-TARGETED BNs:	--	--	--	20.66	25.59	12.54
Dioxin	--	--	--	ND	ND	ND

COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Dilution Factor	--	--				
Priority Pollutant Metals						
Arsenic	20	20	NLE	105	2.06	2.6
Beryllium	1	1	NLE	0.869	ND	0.609
Cadmium	1	1	NLE	2.21	ND	0.259
Chromium	120000	NLE	NLE	376	27	43
Chromium, (hexvalent)	NLE	NLE	NLE	ND	ND	ND
Copper	600	600	NLE	295	7.34	20.7
Lead	400	600	NLE	337	5.63	11.8
Mercury	14	270	NLE	2.47	0.032	ND
Nickel	250	2400	NLE	64.5	7.72	39.8
Silver	110	4100	NLE	2.31	ND	ND
Thallium	2	2	NLE	0.42	ND	0.093
Zinc	1500	1500	NLE	499	18.4	72.3

COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Total Organic Carbon	--	--	--	18.000	1.400	3.100

TABLE 1

ft bgs - feet below ground surface

**SUMMARY OF SEDIMENT ANALYTICAL RESULTS**  
**COLLECTED JANUARY 17, 2000 - JANUARY 19, 2000**  
**STANDARD CHLORINE**  
**KEARNY, NEW JERSEY**

NLE - No Level Established

MDL - Method Detection Limit

ppm - parts per million

Q - Qualifier

D - Diluted

ND - Not Detected

J - Concentration detected below MDL

**Enviro-Sciences, Inc.**

Sample ID Number	RESIDENTIAL	NON-RESIDENTIAL	Impact to	TPS-C1-1	TPS-C1-5	TPS-C1-10
Laboratory Sample Number:	Direct Contact	Direct Contact	Groundwater	310-010	310-011	364-006
Depth Collected (ft bgs)	Soil Cleanup	Soil Cleanup	Soil Cleanup	1.0	5.0	10
Date Sampled:	Criteria	Criteria	Criteria	01/17/00	01/17/00	01/19/00
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	MDL CONC Q	MDI CONC Q	MDL CONC Q
Dilution Factor	--	--	--			
VO+10						
TOTAL TARGETED VOs:	---	---	---	ND	ND	ND
TOTAL NON-TARGETED VOs:	---	---	---	2	ND	ND
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Dilution Factor	--	--	--			
BN+15						
Acenaphthene	3400	10000	100	11.7	ND	ND
Acenaphthylene	NLE	NLE	NLE	50.4	0.4	ND
Anthracene	1000	10000	100	75.2	0.4	ND
Benzo(a)anthracene	0.90	4	500	304	1.4	ND
Benzo(a)pyrene	0.66	0.66	100	281	2.0	ND
Benzo(b)fluoranthene	0.90	0.66	50	391	2.3	ND
Benzo(g,h,i)perylene	NLE	NLE	NLE	219	1.5	ND
Benzo(k)fluoranthene	0.90	4	500	130	0.9	ND
Bis(2-ethylhexyl)phthalate	49	210	100	ND	0.4	ND
Carbazole	NLE	NLE	NLE	27.1	ND	ND
Chrysene	9	40	500	259	0.8	ND
Dibenzo(a,h)anthracene	0.66	0.66	100	61.2	0.5	ND
Dibenzofuran	NLE	NLE	NLE	18.7	ND	ND
Di-n-butylphthalate	5700	10000	100	ND	0.2 J	ND
Fluoranthene	2300	10000	100	740	2.2	ND
Fluorene	2300	10000	100	37.5	ND	ND
Indeno(1,2,3-cd)pyrene	0.90	4	500	190	1.3	ND
2-Methylnaphthalene	NLE	NLE	NLE	4.4 J	ND	ND
Naphthalene	230	4200	100	28.3	0.4	ND
Phenanthrene	NLE	NLE	NLE	414	1.0	ND
Pyrene	63	3100	100	581	2.8	ND
TOTAL TARGETED BNs:	--	--	--	3,823.5	18.4	ND
TOTAL NON-TARGETED BNs:	--	--	--	474.2	ND	ND
Dioxins	--	--	--	ND	ND	ND
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Dilution Factor	--	--	--			
Priority Pollutant Metals						
Arsenic	20	20	NLE	15.1	14.6	0.75
Beryllium	1	1	NLE	ND	ND	0.32
Cadmium	1	1	NLE	1.3	ND	ND
Chromium	120000	NLE	NLE	11,700	14,400	14.80
Chromium, (hexavalent)	NLE	NLE	NLE	22.1	ND	ND
Copper	600	600	NLE	50.7	12.4	9.78
Lead	400	600	NLE	119	25.6	5.34
Mercury	14	270	NLE	1.2	2.2	ND
Nickel	250	2400	NLE	241	138	12.20
Silver	110	4100	NLE	ND	ND	ND
Thallium	2	2	NLE	ND	ND	ND
Zinc	1500	1500	NLE	343	114	31.10
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Total Organic Carbon	--	--	--	59,000	49,000	1,000

TABLE 1

ft bgs - feet below ground surface

**SUMMARY OF SEDIMENT ANALYTICAL RESULTS**  
**COLLECTED JANUARY 17, 2000 - JANUARY 19, 2000**  
**STANDARD CHLORINE**  
**LEARNY, NEW JERSEY**

NLE - No Level Established

MDL - Method Detection Limit

ppm - parts per million

Q - Qualifier

D - Diluted

ND - Not Detected

J - Concentration detected below MDL

Enviro-Sciences, Inc.

Sample ID Number	RESIDENTIAL	NON-RESIDENTIAL	Impact to	TPS-C2-1	TPS-C2-5	TPS-C2-10
Laboratory Sample Number:	Direct Contact	Direct Contact	Groundwater	318-004	318-005	364-007
Depth Collected (ft bgs)	Soil Cleanup	Soil Cleanup	Soil Cleanup	1.0	5.0	10.0
Date Sampled:	Criteria	Criteria	Criteria	01/18/00	01/18/00	01/19/00
				MDL CONC Q	MDL CONC Q	MDL CONC Q
COMPOUNDS (units)	(ppm)	(ppm)		(ppm)	(ppm)	(ppm)
Dilution Factor	--	--				
VO+10						
TOTAL TARGETED VOs:	---	---	---	ND	ND	ND
TOTAL NON-TARGETED VOs:	---	---	---	ND	ND	ND

COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Dilution Factor	--	--				
BN+15						
Acenaphthene	3400	10000	100	15.4	ND	ND
Acenaphthylene	NLE	NLE	NLE	39.8	ND	ND
Anthracene	1000	10000	100	127.0	0.2 J	ND
Benzo(a)anthracene	0.90	4	500	260.0	0.9	ND
Benzo(a)pyrene	0.66	0.66	100	217.0	0.5	ND
Benzo(b)fluoranthene	0.90	4.00	50	310.0	0.8	ND
Benzo(g,h,i)perylene	NLE	NLE	NLE	99.4	0.3	ND
Benzo(k)fluoranthene	0.90	4	500	114.0	0.4	ND
Bis(2-ethylhexyl)phthalate	49	210	100	5.8	ND	ND
Carbazole	NLE	NLE	NLE	32.9	ND	ND
Chrysene	9	40	500	200.0	0.4	ND
Dibenzo(a,h)anthracene	0.66	0.66	100	37.8	ND	ND
Dibenzofuran	NLE	NLE	NLE	20.8	ND	ND
Di-n-butylphthalate	5700	10000	100	ND	ND	ND
Fluoranthene	2300	10000	100	733.0	1.4	ND
Fluorene	2300	10000	100	45.7	ND	ND
Indeno(1,2,3-cd)pyrene	0.90	4	500	94.4	0.3	ND
2-Methylnaphthalene	NLE	NLE	NLE	7.0 J	ND	ND
Naphthalene	230	4200	100	21.1	ND	ND
Phenanthrene	NLE	NLE	NLE	521.0	0.4	ND
Pyrene	63	3100	100	503.0	1.4	ND
TOTAL TARGETED BNs:	--	--		3,405.2	6.8	ND
TOTAL NON-TARGETED BNs:	--	--		373.2	111.3	ND
Dioxins	--	--		ND	ND	ND

COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Dilution Factor	--	--				
Priority Pollutant Metals						
Arsenic	20	20	NLE	10.5	0.6	2.36
Beryllium	1	1	NLE	0.5	ND	0.40
Cadmium	1	1	NLE	3.3	ND	ND
Chromium	120000	NLE	NLE	2,790	51.3	25.50
Chromium, (hexavalent)	NLE	NLE	NLE	ND	ND	ND
Copper	600	600	NLE	115	5.2	20.90
Lead	400	600	NLE	118	3.1	7.52
Mercury	14	270	NLE	2.9	0.1	ND
Nickel	250	2400	NLE	72.1	2.2	15.30
Silver	110	4100	NLE	0.6	ND	ND
Thallium	2	2	NLE	0.2	ND	ND
Zinc	1500	1500	NLE	300	8.3	39.00

COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Total Organic Carbon	--	--	--	40,000	49,000	390

TABLE 1

ft bgs - feet below ground surface

**SUMMARY OF SEDIMENT ANALYTICAL RESULTS**  
**COLLECTED JANUARY 17, 2000 - JANUARY 19, 2000**  
**STANDARD CHLORINE**  
**ARMY, NEW JERSEY**

NLE - No Level Established

MDL - Method Detection Limit

ppm - parts per million

Q - Qualifier

D - Diluted

ND - Not Detected

J - Concentration detected below MDL

Enviro-Sciences, Inc.

Sample ID Number	RESIDENTIAL	NON-RESIDENTIAL	Impact to	TPS-C3-1	TPS-C3-5	TPS-C3-10
Laboratory Sample Number:	Direct Contact	Direct Contact	Groundwater	318-006	310-007	364-008
Depth Collected (ft bgs)	Soil Cleanup	Soil Cleanup	Soil Cleanup	1.0	5.0	10.0
Date Sampled:	Criteria	Criteria	Criteria	01/18/00	01/18/00	01/19/00
				MDL CONC Q	MDL CONC Q	MDL CONC Q
COMPOUNDS (units)	(ppm)	(ppm)		(ppm)	(ppm)	(ppm)
Dilution Factor	--	--				
VO+10						
TOTAL TARGETED VO's:	---	---	---	ND	ND	ND
TOTAL NON-TARGETED VO's:	---	---	---	ND	ND	ND

COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Dilution Factor	--	--				
BN+15						
Acenaphthene	3400	10000	100	ND	ND	ND
Acenaphthylene	NLE	NLE	NLE	ND	ND	ND
Anthracene	1000	10000	100	0.35	ND	ND
Benzo(a)anthracene	0.90	4	500	1.66	0.2	ND
Benzo(a)pyrene	0.66	0.66	100	1.78	0.1	ND
Benzo(b)fluoranthene	0.90	0.66	50	2.56	0.2	ND
Benzo(g,h,i)perylene	NLE	NLE	NLE	0.75	ND	ND
Benzo(k)fluoranthene	0.90	4	500	1.08	ND	ND
Bis(2-ethylhexyl)phthalate	49	210	100	7.04	ND	ND
Carbazole	NLE	NLE	NLE	ND	ND	ND
Chrysene	9	40	500	1.61	0.1	ND
Dibenzo(a,h)anthracene	0.66	0.66	100	0.23	ND	ND
Benzenofuran	NLE	NLE	NLE	ND	ND	ND
n-butylphthalate	5700	10000	100	ND	ND	ND
Fluoranthene	2300	10000	100	3.61	0.4	ND
Fluorene	2300	10000	100	ND	ND	ND
Indeno(1,2,3-cd)pyrene	0.90	4	500	0.75	ND	ND
2-Methylnaphthalene	NLE	NLE	NLE	ND	ND	ND
Naphthalene	230	4200	100	ND	ND	ND
Phenanthrene	NLE	NLE	NLE	1.02	ND	ND
Pyrene	63	3100	100	2.96	0.4	ND
TOTAL TARGETED BN's:	--	--	--	25.38	1.5	ND
TOTAL NON-TARGETED BN's:	--	--	--	2,679	56	ND
Dioxins	--	--	--	ND	ND	ND

COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Dilution Factor	--	--	--			
Priority Pollutant Metals						
Arsenic	20	20	NLE	13.5	0.5	0.75
Beryllium	1	1	NLE	0.3	ND	0.32
Cadmium	1	1	NLE	1.9	ND	ND
Chromium	120000	NLE	NLE	4,580	53	14.80
Chromium, (hexavalent)	NLE	NLE	NLE	ND	ND	ND
Copper	600	600	NLE	67.2	11.5	9.79
Lead	400	600	NLE	100	2.7	5.34
Mercury	14	270	NLE	1.7	0.3	ND
Nickel	250	2400	NLE	94.1	2.1	12.20
Silver	110	4100	NLE	0.6	ND	ND
Thallium	2	2	NLE	0.2	ND	ND
Zinc	1500	1500	NLE	224	94.2	31.30

COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Total Organic Carbon	--	--	--	17,000	23,000	450

TABLE 2

**SUMMARY OF SEDIMENT ANALYTICAL RESULTS  
COLLECTED JANUARY 17, 2000 - JANUARY 19, 2000 BY ESI  
STANDARD CHLORINE  
KEARNY, NEW JERSEY**

## NOTES.

ft bgs - feet below ground surface

LEL - Lowest Effects Level

SEL - Severe Effects Level

NLE - No Level Established

MDL - Method Detection Limit

ppm - parts per million

Q - Qualifier

D - Diluted

ND - Not Detected

J - Concentration detected below MDL

**Enviro-Sciences, Inc.**

Sample ID Number Laboratory Sample Number: Depth Collected (ft bgs) Date Sampled:	Marine/Estuarine Screening Guidelines ER-L (1)	Marine/Estuarine Screening Guidelines ER-M (2)	TPS-A1-1 310-001 1.0 01/17/00 MDL CONC Q	TPS-A2-1 310-002 1.0 01/17/00 MDL CONC Q	TPS-A3-1 310-004 1.0 01/17/00 MDL CONC Q
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Dilution Factor	--	--			
<b><u>Volatiles Organic</u></b>					
Benzene	0.34	--	ND	ND	ND
Trichloroethylene	1.6	--	ND	ND	ND
Tetrachloroethylene	0.45	--	ND	ND	ND
Ethylbenzene	1.4	--	ND	ND	ND
Toluene	2.5	--	ND	ND	ND
Xylene	>0.12	--	ND	ND	ND
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Dilution Factor	--	--			
<b><u>Polynuclear Aromatic</u></b>					
Acenaphthene	0.016	0.5	ND	ND	0.25 J
Acenaphthylene	0.044	0.64	ND	ND	2.22
Anthracene	0.085	1.1	ND	0.16 J	4.85
Benzo(a)anthracene	0.261	1.6	0.77 J	0.66	15.00
Benzo(a)pyrene	0.43	1.6	ND	0.54	13.20
Benzo(g,h,i)perylene	0.17	320	ND	0.40	4.50
Benzo(k)fluoranthene	0.24	1,340	ND	0.28	6.65
Chrysene	0.384	2.8	ND	0.53	11.20
Dibenzo(a,h)anthracene	0.063	0.26	ND	ND	1.77
Fluoranthene	0.60	5.1	1.01 J	1.14	41.20
Fluorene	0.019	0.54	ND	ND	0.61
Indeno(1,2,3-cd)pyrene	0.20	320	ND	0.36	4.91
2-Methylnaphthalene	0.07	0.67	ND	ND	ND
Naphthalene	0.16	2.1	200	0.48	0.64
Phenanthrene	0.24	1.5	ND	0.44	4.32
Pyrene	0.665	2.6	1.01 J	0.97 J	26.90
Total PAHs	4	45	202.788	5.96	138.22
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Dilution Factor	--	--			
<b><u>Priority Pollutant Metals</u></b>					
Arsenic	8.2	70	19.5	8.8	31.4
Cadmium	1.2	9.6	0.9	0.6	2.4
Chromium	81	370	3,207	3,197	1,280
Copper	34	270	45.4	17.4	150.0
Lead	47	218	131	81.4	178.0
Mercury	0.15	0.71	0.4	0.2	4.4
Nickel	21	52	208	173	68
Silver	1	3.7	ND	ND	1.7
Zinc	150	410	288	193	362
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
<b><u>Total Organic Carbon</u></b>	--	--	20,000	25,000	22,000
COMPOUNDS (units)	(%)	(%)	(%)	(%)	(%)
<b><u>Total Particle Size</u></b>					
Percent Gravel	--	--	21.95	28.33	77.56
Percent Sand	--	--	74.14	70.25	15.10
Percent Silt and Clay	--	--	3.60	1.24	6.80

(1) - ER-L (Effects Range-Low): Concentration at which adverse benthic impacts are found in approximately 10% of studies.

(2) - ER-M (Effects Range-Median): Concentration at which adverse effects to sensitive species and/or life stages are found in approximately 50% of studies.

\*\*If results are bolded and italicized, results exceed the ER-L or ER-M values.

TABLE 2

**SUMMARY OF SEDIMENT ANALYTICAL RESULTS  
COLLECTED JANUARY 17, 2000 - JANUARY 19, 2000 BY ESI  
STANDARD CHLORINE  
KEARNY, NEW JERSEY**

NOTES  
ft bgs - feet below ground surface  
LEL - Lowest Effects Level  
SEL - Severe Effects Level  
NLE - No Level Established  
MDL - Method Detection Limit  
ppm - parts per million  
Q - Qualifier  
D - Diluted  
ND - Not Detected  
J - Concentration detected below MDL

**Enviro-Sciences, Inc.**

Sample ID Number	Marine/Estuarine	Marine/Estuarine	TPS-B1-1			TPS-B2-1			TPS-B3-1			
Laboratory Sample Number:	Screening	Screening	310-006			318-002			310-008			
Depth Collected (ft bgs)	Guidelines	Guidelines	1.0			1.0			1.0			
Date Sampled:	ER-L (1)	ER-M (2)	01/17/00			01/18/00			01/17/00			
	MDL	CONC	Q	MDL	CONC	Q	MDL	CONC	Q	MDL	CONC	Q
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)			(ppm)			(ppm)			
Dilution Factor	--	--										
<u>Volatile Organic</u>												
Benzene	0.34	--		ND			ND				ND	
Trichloroethylene	1.6	--		ND			ND				ND	
Tetrachloroethylene	0.45	--		ND			ND				ND	
Ethylbenzene	1.4	--		ND			ND				ND	
Toluene	2.5	--		ND			ND				0.38	
Xylene	>0.12	--		ND			ND				ND	
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)			(ppm)			(ppm)			
Dilution Factor	--	--										
<u>Polynuclear Aromatic</u>												
Acenaphthene	0.016	0.5		ND			ND				0.75	
Acenaphthylene	0.044	0.64		ND			ND				0.82	
Anthracene	0.085	1.1		ND			ND				1.98	
Benzo(a)anthracene	0.261	1.6		0.76			0.66				4.31	
Benzo(a)pyrene	0.43	1.6		1.07			0.61				2.79	
Benzo(g,h,i)perylene	0.17	320		0.63			0.22	J			1.36	
Benzo(k)fluoranthene	0.24	1,340		1.93			0.63				1.13	
Chrysene	0.384	2.8		0.60			0.34				2.97	
Dibenzo(a,h)anthracene	0.063	0.26		ND			ND				0.88	
Fluoranthene	0.60	5.1		1.28	J		0.79				4.41	
Fluorene	0.019	0.54		ND			ND				0.51	
Indeno(1,2,3-cd)pyrene	0.20	320		0.44	J		0.21	J			1.38	
2-Methylnaphthalene	0.07	0.67		ND			ND				0.35	J
Naphthalene	0.16	2.1		4570	D		0.73				3.94	
Phenanthrene	0.24	1.5		0.49	J		ND				2.25	
Pyrene	0.665	2.6		0.89			0.56				5.26	
Total PAHs	4	45		4578.09			4.75				35.09	
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)			(ppm)			(ppm)			
Dilution Factor	--	--										
<u>Priority Pollutant Metals</u>												
Arsenic	8.2	70		7.9			38.9				105.0	
Cadmium	1.2	9.6		1.27			1.3				2.2	
Chromium	81	370		1,079			5,240				376	
Copper	34	270		37.0			110.0				295.0	
Lead	47	218		52			192				337.0	
Mercury	0.15	0.71		0.098			6.5				2.5	
Nickel	21	52		50.6			308				65	
Silver	1	3.7		ND			0.9				2.3	
Zinc	150	410		162			420				499	
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)			(ppm)			(ppm)			
Total Organic Carbon	--	--		58,000			11,000				18,000	
COMPOUNDS (units)	(%)	(%)	(%)			(%)			(%)			
<u>Total Particle Size</u>												
Percent Gravel	--	--		42.55			31.94				88.23	
Percent Sand	--	--		52.93			65.33				5.38	
Percent Silt and Clay	--	--		4.42			2.66				4.60	

(1) - ER-L (Effects Range-Low): Concentration at which adverse benthic impacts are found in approximately 10% of studies.

(2) - ER-M (Effects Range-Median): Concentration at which adverse effects to sensitive species and/or life stages are found in approximately 50% of studies.

\*\*If results are bolded and italicized, results exceed the ER-L or ER-M values.



TABLE 2

SUMMARY OF SEDIMENT ANALYTICAL RESULTS  
COLLECTED JANUARY 17, 2000 - JANUARY 19, 2000 BY ESI  
STANDARD CHLORINE  
KEARNY, NEW JERSEY

## NOTES

ft bgs - feet below ground surface

LEL - Lowest Effects Level

SEL - Severe Effects Level

NLE - No Level Established

MDL - Method Detection Limit

ppm - parts per million

Q - Qualifier

D - Diluted

ND - Not Detected

J - Concentration detected below MDL

## Enviro-Sciences, Inc.

Sample ID Number	Marine/Estuarine Screening Guidelines	Marine/Estuarine Screening Guidelines	TPS-C1-1			TPS-C2-1			TPS-C3-1		
Laboratory Sample Number:			310-006			318-004			318-006		
Depth Collected (ft bgs)			1.0			1.0			1.0		
Date Sampled:	ER-L (1)	ER-M (2)	01/17/00			01/18/00			01/18/00		
			MDL	CONC	Q	MDL	CONC	Q	MDL	CONC	Q
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)			(ppm)			(ppm)		
Dilution Factor	--	--									
<b>Volatile Organic</b>											
Benzene	0.34	--		ND			ND			ND	
Trichloroethylene	1.6	--		ND			ND			ND	
Tetrachloroethylene	0.45	--		ND			ND			ND	
Ethylbenzene	1.4	--		ND			ND			ND	
Toluene	2.5	--		ND			ND			ND	
Xylene	>0.12	--		ND			ND			ND	
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)			(ppm)			(ppm)		
Dilution Factor	--	--									
<b>Polynuclear Aromatic</b>											
Acenaphthene	0.016	0.5		11.7			15.4			ND	
Acenaphthylene	0.044	0.64		50.4			39.8			ND	
Anthracene	0.085	1.1		75.2			127			0.35	
Benzo(a)anthracene	0.261	1.6		304			260			1.66	
Benzo(a)pyrene	0.43	1.6		281			217			1.76	
Benzo(g,h,i)perylene	0.17	320		219			99			0.75	
Benzo(k)fluoranthene	0.24	1,340		130			114			1.08	
Chrysene	0.384	2.8		259			200			1.61	
Dibenzo(a,h)anthracene	0.063	0.26		61			38			0.23	
Fluoranthene	0.60	5.1		740			733			3.61	
Fluorene	0.019	0.54		37.5			46			ND	
Indeno(1,2,3-cd)pyrene	0.20	320		190			94			0.75	
2-Methylnaphthalene	0.07	0.67		4.4	J		7	J		ND	
Naphthalene	0.16	2.1		28.3			21			ND	
Phenanthrene	0.24	1.5		414			521			1.02	
Pyrene	0.665	2.6		581			503			2.96	
Total PAHs	4	45		3386.7			3035.6			15.78	
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)			(ppm)			(ppm)		
Dilution Factor	--	--									
<b>Priority Pollutant Metals</b>											
Arsenic	8.2	70		15.1			10.5			13.5	
Cadmium	1.2	9.6		1.3			3.30			1.90	
Chromium	81	370		11,700			2,790			4,580	
Copper	34	270		50.7			115.0			67.2	
Lead	47	218		119			118			100	
Mercury	0.15	0.71		1.2			2.900			1.700	
Nickel	21	52		241			72.1			94.1	
Silver	1	3.7		ND			0.6			0.6	
Zinc	150	410		343			300			224	
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)			(ppm)			(ppm)		
Total Organic Carbon	--	--		59,000			40,000			17,000	
COMPOUNDS (units)	(%)	(%)	(%)			(%)			(%)		
<b>Total Particle Size</b>											
Percent Gravel	--	--		32.87			71.03			50.40	
Percent Sand	--	--		61.25			25.83			42.01	
Percent Silt and Clay	--	--		5.55			3.02			7.39	

(1) - ER-L (Effects Range-Low): Concentration at which adverse benthic impacts are found in approximately 10% of studies.

(2) - ER-M (Effects Range-Median): Concentration at which adverse effects to sensitive species and/or life stages are found in approximately 50% of studies.

\*\*If results are bolded and italicized, results exceed the ER-L or ER-M values.

# REMEDIAL ACTION WORKPLAN

November 2000

Standard Chlorine Chemical Company, Inc.  
1035 Belleville Turnpike  
Kearny, New Jersey

Table 3 – Summary of Sediment Analytical Results  
McLaren-Hart – September 23 – 24, 1992 and May 25 – 26, 1993

TABLE 3

**SUMMARY OF SEDIMENT ANALYTICAL RESULTS  
COLLECTED SEPTEMBER 23-24, 1992  
AND MAY 25-26, 1993 BY MCLAREN-HART  
STANDARD CHLORINE  
KEARNY, NEW JERSEY**

## NOTES

HQS - High Level of Contamination

LEL - Lowest Effects Level

SEL - Severe Effects Level

NEL - No Level Established

MDL - Method Detection Limit

C - Contaminant

D - Diluted

ND - Not Detected

- Concentration exceeds the MDL

## Enviro-Sciences, Inc.

Sample ID Number Laboratory Sample Number:	Manne/Estuarine Screening Guidelines ER-L (1)	Manne/Estuarine Screening Guidelines ER-M (2)	113-SE-125A			113-SE-125B			113-SE-125C		
			MDL	CONC	C	MDL	CONC	C	MDL	CONC	C
COMPOUNDS (units)	(ppm)	(ppm)		(ppm)			(ppm)			(ppm)	
Dilution Factor	--	--									
Date Sampled:	--	--		05/25/93			05/25/93			05/25/93	
<b><u>Volatile Organic</u></b>											
Benzene	0.34	--		ND			0.14			ND	
Ethylbenzene	1.4	--		ND			0.73			ND	
Toluene	2.5	--		ND			0.017			ND	
Xylene	>0.12	--		ND			0.16			ND	
COMPOUNDS (units)	(ppm)	(ppm)		(ppm)			(ppm)			(ppm)	
Dilution Factor	--	--									
Date Sampled:	--	--		09/23/92			09/23/92			09/23/92	
<b><u>Polynuclear Aromatic</u></b>											
Acenaphthene	0.015	0.5		0.34			5.9			ND	
Acenaphthylene	0.044	0.64		0.19			0.92			ND	
Anthracene	0.085	1.1		0.82			6.9			0.067	
Benzo(a)anthracene	0.251	1.6		3.00			7.8			0.26	
Benzo(a)pyrene	0.43	1.6		2.90			6.4			0.3	
Benzo(g,h,i)perylene	0.17	320		0.77			2.3			0.043	
Benzo(k)fluoranthene	0.24	1,340		ND			ND			ND	
Chrysene	0.384	2.8		ND			8			0.27	
Dibenzo(a,h)anthracene	0.063	0.26		ND			0.69			ND	
Fluoranthene	0.60	5.1		7.20			10			0.68	
Fluorene	0.019	0.54		0.20			4.2			ND	
Indeno(1,2,3-cd)pyrene	0.20	320		0.10			2.2			ND	
2-Methylnaphthalene	0.07	0.67		0.17			0.69			0.054	
Naphthalene	0.16	2.1		1.1			0.77			0.5	
Phenanthrene	0.24	1.5		1.50			20			0.18	
Pyrene	0.655	2.5		7.10			17			0.61	
Total PAHs	4	45		25.39			93.67			2.964	
COMPOUNDS (units)	(ppm)	(ppm)		(ppm)			(ppm)			(ppm)	
Dilution Factor	--	--									
Date Sampled:	--	--		09/23/92			09/23/92			09/23/92	
<b><u>Pesticides</u></b>											
Chloroane	0.007	--		ND			ND			ND	
Dieldrin	0.002	--		0.0072			ND			ND	
COMPOUNDS (units)	(ppm)	(ppm)		(ppm)			(ppm)			(ppm)	
Date Sampled:	--	--		09/23/92			09/23/92			09/23/92	
<b><u>PCB (total)</u></b>	0.023	0.18									
Aroclor 1248	0.03	150		ND			ND			0.03	
Aroclor 1254	0.06	34		ND			ND			ND	

(1) - ER-L (Effects Range-Low): Concentration at which adverse benthic impacts are found in approximately 10% of studies

(2) - ER-M (Effects Range-Median): Concentration at which adverse effects to sensitive species and/or life stages are found in approximately 50% of studies.

\*\*If results are bolded and italicized, results exceed the ER-L or ER-M values.

TABLE 3

**SUMMARY OF SEDIMENT ANALYTICAL RESULTS  
COLLECTED SEPTEMBER 23-24, 1992  
AND MAY 25-26, 1993 BY MCLAREN-HART  
STANDARD CHLORINE  
KEARNY, NEW JERSEY**

## NOTES

EPA Interim Sediment Quality

ER-L - Lowest Effects Level

ER-M - Severe Effects Level

MDL - No Level Established

MDL - Method Detection Limit

ppm - Parts per million

Q - Quotient

D - Detected

ND - Not Detected

\* Comparing to ER-M or ER-L MDL

Enviro-Sciences, Inc.

Sample ID Number	Marine/Estuarine Screening Guidelines ER-L (1)	Marine/Estuarine Screening Guidelines ER-M (2)	113-SE-126A		113-SE-126B		113-SE-126C	
Laboratory Sample Number:			MDL	CONC	Q	MDL	CONC	Q
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)			(ppm)		
Dilution Factor	--	--						
	--	--	05/26/93			05/26/93		
<b><u>Volatile Organic</u></b>								
Benzene	0.34	--		ND		0.41		ND
Ethylbenzene	1.4	--		ND		ND		ND
Toluene	2.5	--		ND		ND		ND
Xylene	>0.12	--		ND		ND		ND
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)			(ppm)		
Dilution Factor	--	--						
Date Sampled:	--	--	09/23/92			09/23/92		
<b><u>Polynuclear Aromatic</u></b>								
Acenaphthene	0.016	0.5		ND		7.1		ND
Acenaphthylene	0.044	0.64		ND		2		ND
Anthracene	0.085	1.1		ND		21		ND
Benzo(a)anthracene	0.261	1.6		1.50		26		ND
Benzo(a)pyrene	0.43	1.6		1.40		17		ND
Benzo(g,h,i)perylene	0.17	320		0.48		4.9		ND
Benzo(k)fluoranthene	0.24	1,340		0.81		ND		ND
Chrysene	0.384	2.8		1.30		ND		ND
Dibenzo(a,h)anthracene	0.063	0.26		ND		ND		ND
Fluoranthene	0.60	5.1		2.50		35		ND
Fluorene	0.019	0.54		ND		ND		ND
Indeno(1,2,3-cd)pyrene	0.20	320		0.54		5.6		ND
2-Methylnaphthalene	0.07	0.67		ND		5.4		ND
Naphthalene	0.16	2.1		0.48		7.6		170
Phenanthrene	0.24	1.5		0.62		43		ND
Pyrene	0.665	2.6		2.20		46		ND
Total PAHs	4	45		11.83		220.6		170
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)			(ppm)		
Dilution Factor	--	--						
Date Sampled:	--	--	09/23/92			09/23/92		
<b><u>Pesticides</u></b>								
Chlordane	0.007	--		0.0051		ND		ND
Dieldrin	0.002	--		ND		ND		ND
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)			(ppm)		
Date Sampled:	--	--	09/23/92			09/23/92		
<b><u>PCB (total)</u></b>	0.023	0.18						
Aroclor 1248	0.03	150		ND		ND		ND
Aroclor 1254	0.06	34		0.21		ND		ND

(1) - ER-L (Effects Range-Low): Concentration at which adverse benthic impacts are found in approximately 10% of studies

(2) - ER-M (Effects Range-Median): Concentration at which adverse effects to sensitive species and/or life stages are found in approximately 50% of studies.

\*\*If results are bolded and italicized, results exceed the ER-L or ER-M values.

# REMEDIAL ACTION WORKPLAN

November 2000

Standard Chlorine Chemical Company, Inc.  
1035 Belleville Turnpike  
Kearny, New Jersey

Table 4 – Summary of Surface Water Analytical Results  
ERM – August 28, 1996

TABLE 4

SUMMARY OF SURFACE WATER ANALYTICAL RESULTS  
COLLECTED AUGUST 28, 1996 BY ERM, INC.  
STANDARD CHLORINE  
NEW JERSEY

NOTES  
NLE = NO LIFE ENDANGERMENT  
MDL = MAXIMUM DESIGN FLOW  
C = CHLORINE  
D = DILUTION  
ND = NOT DETECTED  
C = CONCENTRATION

Micro-Sciences, Inc.

Sample ID Number Laboratory Sample Number Date Sampled	Acute Surface Water Quality Standards for SE Waters	Chronic Surface Water Quality Standards for SE Waters	Other, Surface Water Quality Standards for SE Waters	SW-1 08.28.96			SW-2 08.28.96			SW-3 08.28.96			SW-4 08.28.96		
COMPOUNDS (units)	(ug/L)	(ug/L)	(ug/L)	MDL	CONC	C	MDL	CONC	C	MDL	CONC	C	MDL	CONC	C
Benzene			71 (NC)	5	ND		5	ND		5	ND		5	ND	
Bromotorm			360 (NC)	5	ND		5	ND		5	ND		5	ND	
Carbon tetrachloride			531 (NC)	5	ND		5	ND		5	ND		5	ND	
Chlorobenzene			21000 (NC)	5	ND		5	ND		5	ND		5	ND	
Chloroform			470 (NC)	5	ND		5	ND		5	ND		5	ND	
1,2-Dichlorobenzene			16500 (NC)	5	1.57	J	5	1.43	J	5	6.13		5	3.14	
1,3-Dichlorobenzene			22200 (NC)	5	ND		5	ND		5	4.56		5	ND	
1,4-Dichlorobenzene			3159 (NC)	5	1.47	J	5	1.21	J	5	6.37		5	1.6	J
1,2-Dichloroethane			99 (NC)	5	ND		5	ND		5	ND		5	ND	
Ethylbenzene			27900 (NC)	5	ND		5	ND		5	ND		5	ND	
Ethyl bromide			4000 (NC)	5	ND		5	ND		5	ND		5	ND	
Ethylene chloride			1600 (NC)	5	ND		5	ND		5	ND		5	ND	
Tetrachloroethylene			4.29 (NC)	5	ND		5	ND		5	ND		5	ND	
Toluene			200000 (NC)	5	ND		5	ND		5	ND		5	ND	
1,2,4-Trichlorobenzene			113 (NC)	5	ND		5	ND		5	ND		5	1.63	J
Trichloroethylene			81 (NC)	5	ND		5	ND		5	ND		5	ND	
Trinyl Chloride			525 (NC)	5	ND		5	ND		5	ND		5	ND	
Other Parameters															
pH			6.5-8.5		7.12			7.12			7.04			7.13	
Hardness			NLE		2500			2700			2900			2500	

Progenetic effect-based human health criteria as a 30-day average with no frequency exceedence at or above design flows specified in N.J.A.C. 7:9B-1.5(c)2

Progenetic effect-based human health criteria as a 70-year average with no frequency of exceedence at or above the design flows specified in NJAC 7:9B-1.5(c)2

xic substances considered to be possible carcinogens as a 70-year average with no frequency exceedence at or above design flows specified in N.J.A.C. 7:9B-1.5(c)2 and are based on a risk level of one-in-one hundred thousand

# REMEDIAL ACTION WORKPLAN

November 2000

Standard Chlorine Chemical Company, Inc.  
1035 Belleville Turnpike  
Kearny, New Jersey

Table 5 – Summary of Sediment Analytical Results  
ERM – August 28 – 29, 1996

TABLE 5

**SUMMARY OF SEDIMENT ANALYTICAL RESULTS**  
**LECTED AUGUST 28-29, 1996 BY ERM, INC.**  
**JARD CHLORINE**  
**ARMY, NEW JERSEY**

## NOTES

ft bgs - feet below ground surface

LEL - Lowest Effects Level

SEL - Severe Effects Level

NLE - No Level Established

MDL - Method Detection Limit

ppm - parts per million

Q - Quinier

D - Diluted

ND - Not Detected

J - Concentration detected below MDL

Enviro-Sciences, Inc.

Sample ID Number	Marine/Estuarine Screening Guidelines ER-L (1)	Marine/Estuarine Screening Guidelines ER-M (2)	SED-A1 BRI336 08/29/96			SED-A2 BRI335 08/29/96			SED-A3 BRI339 08/29/96		
Laboratory Sample Number:			MDL	CONC	Q	MDL	CONC	Q	MDL	CONC	Q
Depth Collected (ft bgs)											
Date Sampled:											
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)			(ppm)			(ppm)		
Dilution Factor	--	--									
<b><u>Volatile Organic</u></b>											
Benzene	0.34	--		ND			ND			0.00463	J
1,1-dichloroethylene	1.6	--		ND			ND			ND	
1,1,2-trichloroethylene	0.45	--		ND			ND			ND	
1,2-dichlorobenzene	1.4	--		ND			ND			0.0157	
1,4-dichlorobenzene	2.5	--		ND			ND			0.00764	J
1,2-dichlorobenzene	>0.12	--		ND			ND			0.00779	J
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)			(ppm)			(ppm)		
Dilution Factor	--	--									
<b><u>Polynuclear Aromatic</u></b>											
1,2,3,4-tetrahydronaphthalene	0.16	2.1		0.00258	J		0.0335			0.367	
Total PAHs	4	45		0.00258			0.0335			0.367	
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)			(ppm)			(ppm)		
<b><u>Organic Carbon</u></b>	--	--		33,500			56,650			59,750	
<b><u>H</u></b>	--	--		6.38			6.63			6.20	

1) - ER-L (Effects Range-Low): Concentration at which adverse benthic impacts are found in approximately 10% of studies.

2) - ER-M (Effects Range-Median): Concentration at which adverse effects to sensitive species and/or life stages are found in approximately 50% of studies.

\*\*If results are bolded and italicized, results exceed the ER-L or ER-M values.



BLE 5

**SUMMARY OF SEDIMENT ANALYTICAL RESULTS**  
**TESTED AUGUST 28-29, 1996 BY ERM, INC.**  
**HAZARDOUS WASTE SITE**  
**NEW JERSEY**

## NOTES

ft bgs - feet below ground surface

ER-L - Lowest Effects Level

ER-M - Median Effects Level

NLE - No Level Established

MDL - Method Detection Limit

ppm - parts per million

Q - Quota

D - Diluted

ND - Not Detected

J - Concentration detected is less than MDL

viro-Sciences, Inc.

Sample ID Number	Manne/Estuarine Screening Guidelines ER-L (1)	Manne/Estuarine Screening Guidelines ER-M (2)	SED-61 BR1933 08/28/96			SED-62 BR1934 08/29/96			SED-63 BR 935 08/29/96		
Drill Sample Number:			MDL	CONC	Q	MDL	CONC	Q	MDL	CONC	Q
Depth Collected (ft bgs)											
Sampled:											
POUNDS (units)	(ppm)	(ppm)	(ppm)			(ppm)			(ppm)		
Location Factor	--	--									
<u>Polynuclear Aromatic</u>											
benzene	0.34	--		ND			ND			ND	
chloroethylene	1.6	--		ND			ND			ND	
trichloroethylene	0.45	--		ND			ND			ND	
toluene	1.4	--		ND			ND			ND	
styrene	2.5	--		ND			ND			ND	
vinylbenzene	>0.12	--		ND			ND			ND	
POUNDS (units)	(ppm)	(ppm)	(ppm)			(ppm)			(ppm)		
Location Factor	--	--									
<u>Polynuclear Aromatic</u>											
anthracene	0.16	2.1		0.00357	J		0.00688	J		0.00744	J
total PAHs	4	45		0.00357			0.00688			0.00744	
POUNDS (units)	(ppm)	(ppm)	(ppm)			(ppm)			(ppm)		
<u>Organic Carbon</u>	--	--		33,450			24,550			22,050	
	--	--		7.52			7.50			7.59	

ER-L (Effects Range-Low): Concentration at which adverse benthic impacts are found in approximately 10% of studies.

ER-M (Effects Range-Median): Concentration at which adverse effects to sensitive species and/or life stages are found in approximately 50% of studies.

Results are bolded and italicized, results exceed the ER-L or ER-M values.

TABLE 5

**SUMMARY OF SEDIMENT ANALYTICAL RESULTS  
COLLECTED AUGUST 28-29, 1996 BY ERM, INC.  
STANDARD CHLORINE  
KEARNY, NEW JERSEY**

Enviro-Sciences, Inc.

## NOTES

R bgs - feet below ground surface

LEL - Lowest Effects Level

SEL - Severe Effects Level

NLE - No Level Established

MDL - Method Detection Limit

ppm - parts per million

Q - Quicker

D - Diluted

ND - Not Detected

J - Concentration detected below MDL

Sample ID Number	Marine/Estuarine	Marine/Estuarine	SED-C1		
Laboratory Sample Number:	Screening	Screening	BR1940		
Depth Collected (ft bgs)	Guidelines	Guidelines			
Date Sampled:	ER-L (1)	ER-M (2)	08/28/96		
			MDL	CONC	Q
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)		
Dilution Factor	--	--			
<u>Volatiles Organic</u>					
Benzene	0.34	--		ND	
Trichloroethylene	1.6	--		ND	
Tetrachloroethylene	0.45	--		ND	
Ethylbenzene	1.4	--		ND	
Toluene	2.5	--		ND	
Xylene	>0.12	--		ND	
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)		
Dilution Factor	--	--			
<u>Polynuclear Aromatic</u>					
Naphthalene	0.15	2.1		ND	
Total PAHs	4	45		0	
COMPOUNDS (units)	(ppm)	(ppm)	(ppm)		
<u>Total Organic Carbon</u>	--	--		48.050	
<u>pH</u>	--	--		4.45	

<sup>(1)</sup> - ER-L (Effects Range-Low): Concentration at which adverse benthic impacts are found in approximately 50% of studies.

<sup>(2)</sup> - ER-M (Effects Range-Median): Concentration at which adverse effects to sensitive species and/or life stages are found in approximately 50% of studies.

\*\*If results are bolded and italicized, results exceed the ER-L or ER-M values.

**2002 EPA Superfund Contract Support Team Sampling Report  
Surface Water/Sediment**

TABLE 1 - VOLATILE ORGANIC COMPOUND SAMPLE SUMMARY

VOCs	SC-SED-01	SC-SW-01	SC-SED-02	SC-SW-02
	ug/Kg	ug/L	ug/Kg	ug/L
Dichlorodifluoromethane	ND	ND	ND	ND
Chloromethane	ND	ND	ND	ND
Vinyl Chloride	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND
Trichlorofluoromethane	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND
Acetone	ND	3 J	ND	12 JQE
Methyl acetate	ND	ND	ND	ND
Methylene chloride	ND	ND	ND	ND
trans-1,2-Dichloroethene	ND	ND	ND	ND
cis-1,2-Dichloroethene	ND	ND	ND	ND
Methyl tert-butyl ether	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND
2-Butanone	ND	ND	ND	3 J
Chloroform	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND
Cyclohexane	ND	ND	ND	ND
Carbon Tetrachloride	ND	ND	ND	ND
Benzene	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND
Methylcyclohexane	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND
Dibromochloromethane	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND
4-Methyl-2-pentanone	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND
1,2-Dibromomethane	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	5 J
Ethylbenzene	ND	ND	ND	ND
m,p-Xylene	ND	ND	ND	ND
o-Xylene	ND	ND	ND	ND
Styrene	ND	ND	ND	ND
Isopropylbenzene	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	ND	ND	ND	ND
JQE - Result is estimated because during validation for accuracy, it was found to be below the lower acceptance criteria				
Non detect				
At a low level, the compound was detected, however, the numerical result is estimated.				

TABLE 1 - VOLATILE ORGANIC COMPOUND SAMPLE SUMMARY

VOCs	SC-SED-03	SC-SW-03	SC-SED-04	SC-SW-04
	ug/Kg	ug/L	ug/Kg	ug/L
Chlorodifluoromethane	ND	ND	ND	ND
Chloromethane	ND	ND	ND	ND
Vinyl Chloride	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND
Trichlorofluoromethane	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND
Acetone	ND	13JQE	ND	2 J
Methyl acetate	ND	ND	ND	ND
Methylene chloride	ND	ND	ND	ND
trans-1,2-Dichloroethene	ND	ND	ND	ND
cis-1,2-Dichloroethene	ND	ND	ND	ND
Methyl tert-butyl ether	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND
2-Butanone	ND	3 J	ND	ND
Chloroform	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND
Cyclohexane	ND	ND	ND	ND
Carbon Tetrachloride	ND	ND	ND	ND
Benzene	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND
Methylcyclohexane	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND
Dibromochloromethane	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND
4-Methyl-2-pentanone	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND
1,2-Dibromomethane	ND	ND	ND	ND
Chlorobenzene	ND	4 J	ND	ND
Ethylbenzene	ND	ND	ND	ND
m,p-Xylene	ND	ND	ND	ND
o-Xylene	ND	ND	ND	ND
Styrene	ND	ND	ND	ND
Isopropylbenzene	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	ND	ND	ND	ND
JQE - Result is estimated because during validation for accuracy, it was found to be below the lower acceptance criteria				
Non detect				
At a low level, the compound was detected, however, the numerical result is estimated.				

TABLE 1 - VOLATILE ORGANIC COMPOUND SAMPLE SUMMARY

VOCs	SC-SED-05	SC-SW-05	SC-SED-06	SC-SW-06
	ug/Kg	ug/L	ug/Kg	ug/L
Dichlorodifluoromethane	ND	ND	ND	ND
Chloromethane	ND	ND	ND	ND
Vinyl Chloride	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND
Trichlorofluoromethane	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND	ND	ND	ND
Carbon Disulfide	ND	5 J	ND	ND
Acetone	ND	3 J	ND	27 JQE
Methyl acetate	ND	ND	ND	ND
Methylene chloride	ND	ND	ND	ND
trans-1,2-Dichloroethene	ND	ND	ND	ND
cis-1,2-Dichloroethene	ND	ND	ND	ND
Methyl tert-butyl ether	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND
2-Butanone	ND	ND	ND	5 J
Chloroform	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND
Cyclohexane	ND	ND	ND	ND
Carbon Tetrachloride	ND	ND	ND	ND
Benzene	ND	ND	ND	8 J
1,1,1-Trichloroethene	ND	ND	ND	ND
Methylcyclohexane	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND
Dibromochloromethane	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND
4-Methyl-2-pentanone	ND	ND	ND	ND
Toluene	ND	ND	ND	2 J
Tetrachloroethene	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND
1,2-Dibromomethane	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	51
Ethylbenzene	ND	ND	ND	3 J
m,p-Xylene	ND	ND	ND	7 J
o-Xylene	ND	ND	ND	4 J
Styrene	ND	ND	ND	ND
Isopropylbenzene	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	ND	ND	ND	ND
JQE - Result is estimated because during validation for accuracy, it was found to be below the lower acceptance criteria				
Non detect				
At a low level, the compound was detected, however, the numerical result is estimated.				

TABLE 1 - VOLATILE ORGANIC COMPOUND SAMPLE SUMMARY

VOCs	SC-SED-07	SC-SW-07	SC-SED-08	SC-SW-08
	ug/Kg	ug/L	ug/Kg	ug/L
chlorodifluoromethane	ND	ND	ND	ND
Chloromethane	ND	ND	ND	ND
Vinyl Chloride	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND
Trichlorofluoromethane	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND
Acetone	ND	ND	ND	16 JQE
Methyl acetate	ND	ND	ND	ND
Methylene chloride	ND	ND	ND	ND
trans-1,2-Dichloroethene	ND	ND	ND	ND
cis-1,2-Dichloroethene	ND	ND	ND	ND
Methyl tert-butyl ether	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND
2-Butanone	ND	3 J	ND	3 J
Chloroform	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND
Cyclohexane	ND	ND	ND	ND
Carbon Tetrachloride	ND	ND	ND	ND
Benzene	ND	39	ND	9 J
chloroethene	ND	ND	ND	ND
methylcyclohexane	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND
Dibromochloromethane	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND
4-Methyl-2-pentanone	ND	ND	ND	ND
Toluene	ND	6 J	ND	3 J
Tetrachloroethene	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND
1,2-Dibromomethane	ND	ND	ND	ND
Chlorobenzene	860 J	260 J	ND	68 JQP
Ethylbenzene	ND	7 J	ND	2 J
m,p-Xylene	ND	8 J	ND	4 J
o-Xylene	ND	6 J	ND	2 J
Styrene	ND	ND	ND	ND
Isopropylbenzene	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	ND	ND	ND	ND
JQE - Result is estimated because during validation for accuracy, it was found to be below the lower acceptance criteria				
Non detect				
At a low level, the compound was detected, however, the numerical result is estimated.				
JQP - The result was estimated because sample replicate precision did not meet acceptance criteria				

TABLE 1 - VOLATILE ORGANIC COMPOUND SAMPLE SUMMARY

VOCs	SC-SED-09	SC-SW-09	SC-SED-10	SC-SW-10
	ug/Kg	ug/L	ug/Kg	ug/L
Dichlorodifluoromethane	ND	ND	ND	ND
Chloromethane	ND	ND	ND	ND
Vinyl Chloride	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND
Trichlorofluoromethane	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND
Acetone	ND	9.0 J	ND	6.0 J
Methyl acetate	ND	ND	ND	ND
Methylene chloride	ND	ND	ND	ND
trans-1,2-Dichloroethene	ND	ND	ND	ND
cis-1,2-Dichloroethene	ND	ND	ND	ND
Methyl tert-butyl ether	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND
2-Butanone	ND	2.0 J	ND	ND
Chloroform	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND
Cyclohexane	ND	ND	ND	ND
Carbon Tetrachloride	ND	ND	ND	ND
Benzene	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND
Methylcyclohexane	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND
Dibromochloromethane	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND
4-Methyl-2-pentanone	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND
1,2-Dibromomethane	ND	ND	ND	ND
Chlorobenzene	ND	3.0 J	ND	2.0 J
Ethylbenzene	ND	ND	ND	ND
m,p-Xylene	ND	ND	ND	ND
o-Xylene	ND	ND	ND	ND
Styrene	ND	ND	ND	ND
Isopropylbenzene	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	ND	ND	ND	ND
ND - Non detect				
J - at a low level, the compound was detected, however, the numerical result is estimated.				



TABLE 1 - VOLATILE ORGANIC COMPOUND SAMPLE SUMMARY

VOCs	SC-SED-30	SC-SW-30	SC-SED-11	SC-SW-11
	ug/Kg	ug/L	ug/Kg	ug/L
Dichlorodifluoromethane	ND	ND	ND	ND
Chloromethane	ND	ND	ND	ND
Vinyl Chloride	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND
Trichlorofluoromethane	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND
Acetone	ND	6.0 J	ND	9.0 J
Methyl acetate	ND	ND	ND	ND
Methylene chloride	ND	ND	ND	ND
trans-1,2-Dichloroethene	ND	ND	ND	ND
cis-1,2-Dichloroethene	ND	ND	ND	ND
Methyl tert-butyl ether	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND
2-Butanone	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND
Cyclohexane	ND	ND	ND	ND
Carbon Tetrachloride	ND	ND	ND	ND
Benzene	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND
Methylcyclohexane	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND
Dibromochloromethane	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND
4-Methyl-2-pentanone	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND
1,2-Dibromomethane	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	3.0 J
Ethylbenzene	ND	ND	ND	ND
m,p-Xylene	ND	ND	ND	ND
o-Xylene	ND	ND	ND	ND
Styrene	ND	ND	ND	ND
Isopropylbenzene	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	ND	ND	ND	ND
ND - Non detect				
J - at a low level, the compound was detected, however, the numerical result is estimated.				
SC-SED-30 is a duplicate of SC-SED-10 and SC-SW-30 is a duplicate of SC-SW-10				

TABLE 1 - VOLATILE ORGANIC COMPOUND SAMPLE SUMMARY

VOCs	SC-SED-12	SC-SW-12	SC-SED-13	SC-SW-13
	ug/Kg	ug/L	ug/Kg	ug/L
Dichlorodifluoromethane	ND	ND	ND	ND
Chloromethane	ND	ND	ND	ND
Vinyl Chloride	ND	ND	ND	ND
Bromomethane	ND	2.0 J	ND	ND
Chloroethane	ND	ND	ND	ND
Trichlorofluoromethane	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND
Acetone	ND	22 JQE	ND	5.0 J
Methyl acetate	ND	ND	ND	ND
Methylene chloride	ND	ND	ND	ND
trans-1,2-Dichloroethene	ND	ND	ND	ND
cis-1,2-Dichloroethene	ND	ND	ND	ND
Methyl tert-butyl ether	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND
2-Butanone	ND	4.0 J	ND	ND
Chloroform	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND
Cyclohexane	ND	ND	ND	ND
Carbon Tetrachloride	ND	ND	ND	ND
Benzene	ND	8.0 J	ND	ND
1,1,1-Trichloroethene	ND	ND	ND	ND
Methylcyclohexane	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND
Dibromochloromethane	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND
4-Methyl-2-pentanone	ND	ND	ND	ND
Toluene	ND	2.0 J	ND	ND
Tetrachloroethene	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND
1,2-Dibromomethane	ND	ND	ND	ND
Chlorobenzene	ND	31	14,000	3.0 J
Ethylbenzene	ND	4.0 J	ND	ND
m,p-Xylene	ND	6.0 J	ND	ND
o-Xylene	ND	4.0 J	ND	ND
Styrene	ND	ND	ND	ND
Isopropylbenzene	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	ND	ND	ND	ND
JQE - Result is estimated because during validation for accuracy, it was found to be below the lower acceptance criteria				
Non detect				
At a low level, the compound was detected, however, the numerical result is estimated.				

TABLE 1 - VOLATILE ORGANIC COMPOUND SAMPLE SUMMARY

VOCs	SC-SED-14	SC-SW-14	SC-SED-15	SC-SW-15
	ug/Kg	ug/L	ug/Kg	ug/L
Trichlorodifluoromethane	ND	ND	ND	ND
Chloromethane	ND	ND	ND	ND
Vinyl Chloride	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND
Trichlorofluoromethane	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND
Acetone	ND	5.0 J	ND	5.0 J
Methyl acetate	ND	ND	ND	ND
Methylene chloride	ND	ND	ND	ND
trans-1,2-Dichloroethene	ND	ND	ND	ND
cis-1,2-Dichloroethene	ND	ND	ND	ND
Methyl tert-butyl ether	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND
2-Butanone	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND
Cyclohexane	ND	ND	ND	ND
Carbon Tetrachloride	ND	ND	ND	ND
Benzene	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND
Methylcyclohexane	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND
Dibromochloromethane	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND
4-Methyl-2-pentanone	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND
1,2-Dibromomethane	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND
Ethylbenzene	ND	ND	ND	ND
m,p-Xylene	ND	ND	ND	ND
o-Xylene	ND	ND	ND	ND
Styrene	ND	ND	ND	ND
Isopropylbenzene	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	ND	ND	ND	ND
ND - Non detect				
at a low level, the compound was detected, however, the numerical result is estimated.				

TABLE 1 - VOLATILE ORGANIC COMPOUND SAMPLE SUMMARY

VOCs	SC-SED-16	SC-SW-16	SC-SED-17	SC-SW-17
	ug/Kg	ug/L	ug/Kg	ug/L
Chlorodifluoromethane	ND	ND	ND	ND
Chloromethane	ND	ND	ND	ND
Vinyl Chloride	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND
Trichlorofluoromethane	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND
Acetone	ND	6.0 J	ND	4.0 J
Methyl acetate	ND	ND	ND	ND
Methylene chloride	ND	ND	ND	ND
trans-1,2-Dichloroethene	ND	ND	ND	ND
cis-1,2-Dichloroethene	ND	ND	ND	ND
Methyl tert-butyl ether	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND
2-Butanone	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND
Cyclohexane	ND	ND	ND	ND
Carbon Tetrachloride	ND	ND	ND	ND
Benzene	ND	ND	ND	ND
Chloroethene	ND	ND	ND	ND
Methylcyclohexane	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND
Dibromochloromethane	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND
4-Methyl-2-pentanone	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND
1,2-Dibromomethane	ND	ND	ND	ND
Chlorobenzene	2200 J	ND	2000 J	ND
Ethylbenzene	ND	ND	ND	ND
m,p-Xylene	ND	ND	ND	ND
o-Xylene	ND	ND	ND	ND
Styrene	ND	ND	ND	ND
Isopropylbenzene	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	ND	ND	ND	ND
ND - Non detect				
† a low level, the compound was detected, however, the numerical result is estimated.				

TABLE 1 - VOLATILE ORGANIC COMPOUND SAMPLE SUMMARY

VOCs	SC-SED-18	SC-SW-18	SC-SED-31	SC-SW-31
	ug/Kg	ug/L	ug/Kg	ug/L
Chlorodifluoromethane	ND	ND	ND	ND
Chloromethane	ND	ND	ND	ND
Vinyl Chloride	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND
Trichlorofluoromethane	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND
Acetone	ND	5.0 J	ND	5.0 J
Methyl acetate	ND	ND	ND	ND
Methylene chloride	ND	ND	ND	ND
trans-1,2-Dichloroethene	ND	ND	ND	ND
cis-1,2-Dichloroethene	ND	ND	ND	ND
Methyl tert-butyl ether	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND
2-Butanone	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND
Cyclohexane	ND	ND	ND	ND
Carbon Tetrachloride	ND	ND	ND	ND
Benzene	ND	ND	ND	ND
Chloroethene	ND	ND	ND	ND
Methylcyclohexane	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND
Dibromochloromethane	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND
4-Methyl-2-pentanone	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND
1,2-Dibromomethane	ND	ND	ND	ND
Chlorobenzene	2000 J	9.0 J	2100 J	9.0 J
Ethylbenzene	ND	ND	ND	ND
m,p-Xylene	ND	ND	ND	ND
o-Xylene	ND	ND	ND	ND
Styrene	ND	ND	ND	ND
Isopropylbenzene	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	ND	ND	ND	ND
ND - Non detect				
At a low level, the compound was detected, however, the numerical result is estimated.				
SED-31 is a duplicate of SC-SED-18 and SC-SW-31 is a duplicate of SC-SW-18				

TABLE 1 - VOLATILE ORGANIC COMPOUND SAMPLE SUMMARY

VOCs	SC-SED-19	SC-SW-19	SC-SED-20	SC-SW-20
	ug/Kg	ug/L	ug/Kg	ug/L
Dichlorodifluoromethane	ND	ND	ND	3.0 J
Chloromethane	ND	ND	ND	ND
Vinyl Chloride	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND
Trichlorofluoromethane	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	3.0 J
Acetone	ND	5.0 J	ND	11 JQE
Methyl acetate	ND	ND	ND	ND
Methylene chloride	ND	ND	ND	ND
trans-1,2-Dichloroethene	ND	ND	ND	ND
cis-1,2-Dichloroethene	ND	ND	ND	ND
Methyl tert-butyl ether	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND
2-Butanone	ND	ND	ND	2.0 J
Chloroform	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND
Cyclohexane	ND	ND	ND	ND
Carbon Tetrachloride	ND	ND	ND	ND
benzene	ND	15	ND	29
1,1-Dichloroethene	ND	ND	ND	ND
Methylcyclohexane	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND
Dibromochloromethane	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND
4-Methyl-2-pentanone	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND
1,2-Dibromomethane	ND	ND	ND	ND
Chlorobenzene	250,000	250 J	43,000	600
Ethylbenzene	ND	ND	ND	2.0 J
m,p-Xylene	ND	ND	ND	5.0 J
o-Xylene	ND	ND	ND	2.0 J
Styrene	ND	ND	ND	ND
Isopropylbenzene	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	ND	ND	ND	ND
- Result is estimated because during validation for accuracy, it was found to be below the lower acceptance criteria				
Non detect				
At a low level, the compound was detected, however, the numerical result is estimated.				

TABLE 1 - VOLATILE ORGANIC COMPOUND SAMPLE SUMMARY

VOCs	SC-SED-21	SC-SW-21	TB-01	TB-02
	ug/Kg	ug/L	ug/L	ug/L
Dichlorodifluormethane	ND	ND	ND	ND
Chloromethane	ND	ND	ND	ND
Vinyl Chloride	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND
Trichlorofluoromethane	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND	ND	ND	ND
Carbon Disulfide	ND	37	ND	ND
Acetone	ND	3.0 J	ND	ND
Methyl acetate	ND	ND	ND	ND
Methylene chloride	ND	ND	ND	ND
trans-1,2-Dichloroethene	ND	ND	ND	ND
cis-1,2-Dichloroethene	ND	ND	ND	ND
Methyl tert-butyl ether	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND
2-Butanone	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND
Cyclohexane	ND	ND	ND	ND
Carbon Tetrachloride	ND	ND	ND	ND
Benzene	ND	23	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND
Methylcyclohexane	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND
Dibromochloromethane	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND
4-Methyl-2-pentanone	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND
1,2-Dibromomethane	ND	ND	ND	ND
Chlorobenzene	41,000	760	ND	ND
Ethylbenzene	ND	ND	ND	ND
m,p-Xylene	ND	ND	ND	ND
o-Xylene	ND	ND	ND	ND
Styrene	ND	ND	ND	ND
Isopropylbenzene	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	ND	ND	ND	ND
ND - Non detect				
J a low level, the compound was detected, however, the numerical result is estimated.				

TABLE 1 - VOLATILE ORGANIC COMPOUND SAMPLE SUMMARY

VOCs	RB-01
	ug/L
Dichlorodifluormethane	ND
Chloromethane	ND
Vinyl Chloride	ND
Bromomethane	ND
Chloroethane	ND
Trichlorofluoromethane	ND
1,1-Dichloroethene	ND
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND
Carbon Disulfide	ND
Acetone	2 J
Methyl acetate	ND
Methylene chloride	ND
trans-1,2-Dichloroethene	ND
cis-1,2-Dichloroethene	ND
Methyl tert-butyl ether	ND
1,1-Dichloroethane	ND
2-Butanone	ND
Chloroform	ND
1,2-Dichloroethane	ND
1,1,1-Trichloroethane	ND
Cyclohexane	ND
Carbon Tetrachloride	ND
Benzene	ND
1,1-Dichloroethene	ND
Methylcyclohexane	ND
1,2-Dichloropropane	ND
Bromodichloromethane	ND
cis-1,3-Dichloropropene	ND
trans-1,3-Dichloropropene	ND
1,1,2-Trichloroethane	ND
Dibromochloromethane	ND
Bromoform	ND
4-Methyl-2-pentanone	ND
Toluene	ND
Tetrachloroethene	ND
2-Hexanone	ND
1,2-Dibromomethane	ND
Chlorobenzene	ND
Ethylbenzene	ND
m,p-Xylene	ND
o-Xylene	ND
Styrene	ND
Isopropylbenzene	ND
1,1,2,2-Tetrachloroethane	ND
1,2-Dibromo-3-chloropropane	ND
ND - Non detect	
At a low level, the compound was detected, however, the numerical result is estimated.	



TABLE 2 - BASE/NEUTRAL AND ACID SAMPLE SUMMARY

Base/Neutral and Acids	SC-SED-01	SC-SW-01	SC-SED-02	SC-SW-02
	ug/Kg	ug/L	ug/Kg	ug/L
phenol	350 J	ND	ND	ND
bis(2-chloroethyl)Ether	ND	ND	ND	ND
2-Chlorophenol	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	1.0 J
1,4-Dichlorobenzene	190 J	2.0 J	560 J	4.0 J
1,2-Dichlorobenzene	ND	ND	ND	3.0 J
Benzyl alcohol	ND	ND	ND	ND
2-Methylphenol	ND	ND	ND	6.2
bis(2-chloroisopropyl)Ether	ND	ND	ND	ND
4-Methylphenol	270 J	ND	ND	ND
n-Nitros-di-n-propylamine	ND	ND	ND	ND
Hexachloroethane	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND
Isophorone	ND	ND	ND	ND
2-Nitrophenol	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND
bis(2-chloroethoxy)Methane	ND	ND	ND	ND
2,4-Dichlorophenol	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ND	ND	ND	12
Benzoic acid	ND	N/A	ND	N/A
Naphthalene	7100	ND	2800	45
4-Chloroaniline	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND
2-Chloro-3-methylphenol	ND	ND	ND	ND
1-Methyl naphthalene	1900	ND	490 J	10
Hexachlorocyclopentadiene	ND	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND	ND
2,4,5-Trichlorophenol	ND	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND	ND
2-Nitroaniline	ND	ND	ND	ND
Dimethyl phthalate	ND	ND	ND	1.0 J
Acenaphthylene	10000	3.0 J	2500	ND
2,6-Dinitrotoluene	ND	ND	ND	ND
3-Nitroaniline	ND	ND	ND	ND
Acenaphthene	5600	1.0 J	1200 J	2.0 J
2,4-Dinitrophenol	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	ND
Dibenzofuran	6000	ND	1100 J	2.0 J
2,4-Dinitrotoluene	ND	ND	ND	ND
Fluorene	8300	ND	1600	ND
Diethylphthalate	210	ND	ND	ND
4-Chlorophenyl phenyl ether	ND	ND	ND	ND
4-Nitroaniline	ND	ND	ND	ND
4,6-Dinitro-2-methylphenol	ND	ND	ND	ND
n-Nitrosodiphenylamine	ND	ND	ND	ND
Due to a low level, the result is verified, but not quantified				
- Non-detect				

TABLE 2 - BASE/NEUTRAL AND ACID SAMPLE SUMMARY CONTINUED

Base/Neutral and Acids Cont.	SC-SED-01	SC-SW-01	SC-SED-02	SC-SW-02
	ug/Kg	ug/L	ug/Kg	ug/L
Diazene, diphenyl	ND	ND	ND	ND
4-Bromophenyl phenyl ether	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	ND
Pentachlorophenol	ND	ND	ND	ND
Phenanthrene	63000	5.1	11000	ND
Anthracene	23000	4.0 J	4600	ND
Di-n-Butyl phthalate	ND	ND	ND	ND
Fluoranthene	97000	16	20000	ND
Pyrene	83000	19	17000	ND
Butyl benzyl phthalate	ND	ND	ND	ND
Benzo(a)anthracene	61000	7.6	11000	ND
Chrysene	60000	8.6	11000	ND
bis(2-ethylhexyl)Phthalate	4700	11	ND	ND
Di-n-octyl phthalate	ND	ND	ND	ND
Benzo(b)fluoranthene	74000	12	13000	ND
Benzo(k)fluoranthene	27000	4.3	5200	ND
Benzo(a)pyrene	63000	9.1	10000	ND
Indeno(1,2,3-cd)pyrene	43000	6.5	7200	ND
Dibenzo(a,h)anthracene	2300	ND	710 J	ND
Benzo(g,h,i)perylene	41000	6.3	6600	ND
J - Due to a low level, the result is verified, but not quantified				
ND - Non-detect				

TABLE 2 - BASE/NEUTRAL AND ACID SAMPLE SUMMARY

Base/Neutral and Acids	SC-SED-03	SC-SW-03	SC-SED-04	SC-SW-04
	ug/Kg	ug/L	ug/Kg	ug/L
enol	ND	ND	ND	ND
bis(2-chloroethyl)Ether	ND	ND	ND	ND
2-Chlorophenol	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	1.0 J	ND	ND
1,4-Dichlorobenzene	590 J	4.0 J	ND	ND
1,2-Dichlorobenzene	ND	3.0 J	ND	ND
Benzyl alcohol	ND	ND	ND	ND
2-Methylphenol	ND	ND	ND	ND
bis(2-chloroisopropyl)Ether	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	ND
n-Nitros-di-n-propylamine	ND	ND	ND	ND
Hexachloroethane	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND
Isophorone	ND	ND	ND	ND
2-Nitrophenol	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND
bis(2-chloroethoxy)Methane	ND	ND	ND	ND
2,4-Dichlorophenol	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ND	11	ND	ND
Benzoic acid	ND	N/A	ND	N/A
Naphthalene	3600	42	ND	ND
4-Chloroaniline	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND
2-chloro-3-methylphenol	ND	ND	ND	ND
1-Methyl naphthalene	550 J	9.7	ND	ND
Hexachlorocyclopentadiene	ND	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND	ND
2,4,5-Trichlorophenol	ND	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND	ND
2-Nitroaniline	ND	ND	ND	ND
Dimethyl phthalate	ND	ND	ND	ND
Acenaphthylene	5700	ND	ND	ND
2,6-Dinitrotoluene	ND	ND	ND	ND
3-Nitroaniline	ND	ND	ND	ND
Acenaphthene	2300	2.0 J	ND	ND
2,4-Dinitrophenol	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	ND
Dibenzofuran	1600	2.0 J	ND	ND
2,4-Dinitrotoluene	ND	ND	ND	ND
Fluorene	2500	ND	ND	ND
Diethylphthalate	1000	ND	340 J	ND
4-Chlorophenyl phenyl ether	ND	ND	ND	ND
4-Nitroaniline	ND	ND	ND	ND
4,6-Dinitro-2-methylphenol	ND	ND	ND	ND
n-Nitrosodiphenylamine	ND	ND	ND	ND
Due to a low level, the result is verified, but not quantified				
- Non-detect				

TABLE 2 - BASE/NEUTRAL AND ACID SAMPLE SUMMARY CONTINUED

Base/Neutral and Acids Cont.	SC-SED-03	SC-SW-03	SC-SED-04	SC-SW-04
	ug/Kg	ug/L	ug/Kg	ug/L
Diazene, diphenyl	ND	ND	ND	ND
4-Bromophenyl phenyl ether	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	ND
Pentachlorophenol	ND	ND	ND	ND
Phenanthrene	15000	ND	230 J	ND
Anthracene	7400	ND	140 J	ND
Di-n-Butyl phthalate	ND	ND	ND	ND
Fluoranthene	31000	ND	870	ND
Pyrene	24000	ND	690	ND
Butyl benzyl phthalate	ND	ND	ND	ND
Benzo(a)anthracene	17000	ND	490 J	ND
Chrysene	15000	ND	640	ND
bis(2-ethylhexyl)Phthalate	ND	ND	ND	ND
Di-n-octyl phthalate	ND	ND	ND	ND
Benzo(b)fluoranthene	20000	ND	640	ND
Benzo(k)fluoranthene	5700	ND	260 J	ND
Benzo(a)pyrene	15000	ND	460 J	ND
Indeno(1,2,3-cd)pyrene	9000	ND	270 J	ND
Dibenzo(a,h)anthracene	920 J	ND	ND	ND
Benzo(g,h,i)perylene	7700	ND	250 J	ND
J - Due to a low level, the result is verified, but not quantified				
N - Non-detect				

TABLE 2 - BASE/NEUTRAL AND ACID SAMPLE SUMMARY

Base/Neutral and Acids	SC-SED-05	SC-SW-05	SC-SED-06	SC-SW-06
	ug/Kg	ug/L	ug/Kg	ug/L
Phenol	ND	ND	ND	15
bis(2-chloroethyl)Ether	ND	ND	ND	ND
2-Chlorophenol	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	220 J	52
1,4-Dichlorobenzene	380 J	ND	350 J	79
1,2-Dichlorobenzene	ND	ND	400 J	90
Benzyl alcohol	ND	ND	ND	ND
2-Methylphenol	ND	ND	ND	17
bis(2-chloroisopropyl)Ether	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	45
n-Nitros-di-n-propylamine	ND	ND	ND	ND
Hexachloroethane	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND
Isophorone	ND	ND	ND	ND
2-Nitrophenol	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND
bis(2-chloroethoxy)Methane	ND	ND	ND	ND
2,4-Dichlorophenol	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ND	2.0 J	ND	16
Benzoic acid	ND	N/A	ND	N/A
Naphthalene	1900	ND	520 J	77
4-Chloroaniline	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND
2-Chloro-3-methylphenol	ND	ND	ND	ND
1-Methyl naphthalene	ND	ND	430 J	44
Hexachlorocyclopentadiene	ND	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND	3.0 J
2,4,5-Trichlorophenol	ND	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND	ND
2-Nitroaniline	ND	ND	ND	ND
Dimethyl phthalate	ND	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND
2,6-Dinitrotoluene	ND	ND	ND	ND
3-Nitroaniline	ND	ND	ND	ND
Acenaphthene	ND	ND	230 J	13
2,4-Dinitrophenol	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	ND
Dibenzofuran	ND	ND	ND	5.9
2,4-Dinitrotoluene	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND
Diethylphthalate	1300 J	ND	490 J	ND
4-Chlorophenyl phenyl ether	ND	ND	ND	ND
4-Nitroaniline	ND	ND	ND	ND
4,6-Dinitro-2-methylphenol	ND	ND	ND	ND
n-Nitrosodiphenylamine	ND	ND	ND	ND
Due to a low level, the result is verified, but not quantified				
J - Non-detect				

TABLE 2 - BASE/NEUTRAL AND ACID SAMPLE SUMMARY CONTINUED

Base/Neutral and Acids Cont.	SC-SED-05	SC-SW-05	SC-SED-06	SC-SW-06
	ug/Kg	ug/L	ug/Kg	ug/L
Diazene, diphenyl	ND	ND	ND	ND
4-Bromophenyl phenyl ether	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	ND
Pentachlorophenol	ND	ND	ND	ND
Phenanthrene	660 J	ND	730 J	3.0 J
Anthracene	ND	ND	ND	ND
Di-n-Butyl phthalate	ND	ND	ND	ND
Fluoranthene	950 J	1.0 J	830 J	ND
Pyrene	940 J	1.0 J	700 J	ND
Butyl benzyl phthalate	ND	ND	ND	ND
Benzo(a)anthracene	ND	ND	500 J	ND
Chrysene	420 J	ND	680 J	ND
bis(2-ethylhexyl)Phthalate	ND	ND	ND	ND
Di-n-octyl phthalate	ND	ND	ND	ND
Benzo(b)fluoranthene	450 J	ND	850 J	ND
Benzo(k)fluoranthene	ND	ND	320 J	ND
Benzo(a)pyrene	ND	ND	570 J	ND
Indeno(1,2,3-cd)pyrene	ND	ND	430 J	ND
Dibenzo(a,h)anthracene	ND	ND	ND	ND
Benzo(g,h,i)perylene	ND	ND	400 J	ND
J - Due to a low level, the result is verified, but not quantified				
N - Non-detect				

TABLE 2 - BASE/NEUTRAL AND ACID SAMPLE SUMMARY

Base/Neutral and Acids	SC-SED-07	SC-SW-07	SC-SED-08	SC-SW-08
Phenol	ND	ND	ND	ND
bis(2-chloroethyl)Ether	ND	ND	ND	ND
2-Chlorophenol	ND	1.0 J	ND	ND
1,3-Dichlorobenzene	200 J	65	840	29
1,4-Dichlorobenzene	480 J	200	3000	77
1,2-Dichlorobenzene	400 J	150	930	68
Benzyl alcohol	ND	ND	ND	ND
2-Methylphenol	ND	39	ND	24
bis(2-chloroisopropyl)Ether	ND	ND	ND	ND
4-Methylphenol	ND	37	ND	29
n-Nitros-di-n-propylamine	ND	ND	ND	ND
Hexachloroethane	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND
Isophorone	ND	ND	ND	ND
2-Nitrophenol	ND	ND	ND	ND
2,4-Dimethylphenol	ND	81	ND	43
bis(2-chloroethoxy)Methane	ND	ND	ND	ND
2,4-Dichlorophenol	ND	5.9	ND	2.0 J
1,2,4-Trichlorobenzene	430 J	82	1400	33
Benzoic acid	ND	N/A	ND	N/A
Naphthalene	410 J	270	4500	100
4-Chloroaniline	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND
2-Chloro-3-methylphenol	ND	ND	ND	ND
1-Methyl naphthalene	ND	40	1400	24
Hexachlorocyclopentadiene	ND	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND	ND
2,4,5-Trichlorophenol	ND	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND	ND
2-Nitroaniline	ND	ND	ND	ND
Dimethyl phthalate	ND	ND	ND	ND
Acenaphthylene	ND	1.0 J	520 J	ND
2,6-Dinitrotoluene	ND	ND	ND	ND
3-Nitroaniline	ND	ND	ND	ND
Acenaphthene	150 J	38	2400	20
2,4-Dinitrophenol	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	ND
Dibenzofuran	ND	18	1600	10
2,4-Dinitrotoluene	ND	ND	ND	ND
Fluorene	ND	9	1000	4.9
Diethylphthalate	200 J	ND	210 J	ND
4-Chlorophenyl phenyl ether	ND	ND	ND	ND
4-Nitroaniline	ND	ND	ND	ND
4,6-Dinitro-2-methylphenol	ND	ND	ND	ND
n-Nitrosodiphenylamine	ND	ND	ND	ND
Due to a low level, the result is verified, but not quantified				
J - Non-detect				

TABLE 2 - BASE/NEUTRAL AND ACID SAMPLE SUMMARY CONTINUED

Base/Neutral and Acids Cont.	SC-SED-07	SC-SW-07	SC-SED-08	SC-SW-08
	ug/Kg	ug/L	ug/Kg	ug/L
Diazene, diphenyl	ND	ND	ND	ND
4-Bromophenyl phenyl ether	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	330 J	ND
Pentachlorophenol	ND	ND	ND	ND
Phenanthrene	140 J	7.8	2000	4.0 J
Anthracene	ND	ND	630 J	ND
Di-n-Butyl phthalate	ND	ND	ND	ND
Fluoranthene	180 J	1.0 J	2900	ND
Pyrene	160 J	ND	2800	ND
Butyl benzyl phthalate	ND	ND	ND	ND
Benzo(a)anthracene	ND	ND	2000	ND
Chrysene	140 J	ND	2500	ND
bis(2-ethylhexyl)Phthalate	ND	ND	ND	ND
Di-n-octyl phthalate	ND	ND	ND	ND
Benzo(b)fluoranthene	180 J	ND	3200	ND
Benzo(k)fluoranthene	ND	ND	1200	ND
Benzo(a)pyrene	ND	ND	2200	ND
Indeno(1,2,3-cd)pyrene	ND	ND	1800	ND
Dibenzo(a,h)anthracene	ND	ND	ND	ND
Benzo(g,h,i)perylene	ND	ND	1600	ND
J - Due to a low level, the result is verified, but not quantified				
- Non-detect				



TABLE 2 - BASE/NEUTRAL AND ACID SAMPLE SUMMARY

Base/Neutral and Acids	SC-SED-09	SC-SW-09	SC-SED-10	SC-SW-10
	ug/Kg	ug/L	ug/Kg	ug/L
Phenol	450 J	12	ND	ND
bis(2-chloroethyl)Ether	ND	ND	ND	ND
2-Chlorophenol	ND	ND	ND	ND
1,3-Dichlorobenzene	300 J	3.0 J	ND	5.8
1,4-Dichlorobenzene	640 J	5.6	240 J	6
1,2-Dichlorobenzene	230 J	2.0 J	ND	2.0 J
Benzyl alcohol	ND	ND	ND	ND
2-Methylphenol	ND	6.6	ND	ND
bis(2-chloroisopropyl)Ether	ND	ND	ND	ND
4-Methylphenol	290 J	17	ND	ND
n-Nitros-di-n-propylamine	ND	ND	ND	ND
Hexachloroethane	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND
Isophorone	ND	ND	ND	ND
2-Nitrophenol	ND	ND	ND	ND
2,4-Dimethylphenol	ND	2.0 J	ND	ND
bis(2-chloroethoxy)Methane	ND	ND	ND	ND
2,4-Dichlorophenol	ND	ND	ND	ND
1,2,4-Trichlorobenzene	320 J	1.0 J	ND	ND
Benzoic acid	ND	N/A	ND	N/A
Naphthalene	6300	33	ND	ND
4-Chloroaniline	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND
2-Chloro-3-methylphenol	ND	ND	ND	ND
1-Methyl naphthalene	2200	15	ND	ND
Hexachlorocyclopentadiene	ND	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND	ND
2,4,5-Trichlorophenol	ND	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND	ND
2-Nitroaniline	ND	ND	ND	ND
Dimethyl phthalate	ND	ND	ND	ND
Acenaphthylene	610 J	ND	ND	ND
2,6-Dinitrotoluene	ND	ND	ND	ND
3-Nitroaniline	ND	ND	ND	ND
Acenaphthene	700 J	3.0 J	ND	ND
2,4-Dinitrophenol	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	ND
Dibenzofuran	710 J	3.0 J	ND	ND
2,4-Dinitrotoluene	ND	ND	ND	ND
Fluorene	290 J	ND	ND	ND
Diethylphthalate	310 J	ND	340 J	ND
4-Chlorophenyl phenyl ether	ND	ND	ND	ND
4-Nitroaniline	ND	ND	ND	ND
4,6-Dinitro-2-methylphenol	ND	ND	ND	ND
n-Nitrosodiphenylamine	ND	ND	ND	ND
Due to a low level, the result is verified, but not quantified				
J - Non-detect				

TABLE 2 - BASE/NEUTRAL AND ACID SAMPLE SUMMARY CONTINUED

Base/Neutral and Acids Cont.	SC-SED-09	SC-SW-09	SC-SED-10	SC-SW-10
	ug/Kg	ug/L	ug/Kg	ug/L
Diazene, diphenyl	ND	ND	ND	ND
4-Bromophenyl phenyl ether	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	ND
Pentachlorophenol	ND	ND	ND	ND
Phenanthrene	1700	ND	330 J	ND
Anthracene	1100	ND	ND	ND
Di-n-Butyl phthalate	ND	ND	ND	ND
Fluoranthene	3400	ND	820	ND
Pyrene	3400	ND	790	ND
Butyl benzyl phthalate	ND	ND	ND	ND
Benzo(a)anthracene	2500	ND	770 J	ND
Chrysene	3800	ND	800	ND
bis(2-ethylhexyl)Phthalate	ND	ND	ND	ND
Di-n-octyl phthalate	ND	ND	ND	ND
Benzo(b)fluoranthene	4500	ND	920	ND
Benzo(k)fluoranthene	1800	ND	360 J	ND
Benzo(a)pyrene	3200	ND	730	ND
Indeno(1,2,3-cd)pyrene	2500	ND	580 J	ND
Dibenzo(a,h)anthracene	ND	ND	ND	ND
Benzo(g,h,i)perylene	2300	ND	580 J	ND
J - Due to a low level, the result is verified, but not quantified				
ND - Non-detect				

TABLE 2 - BASE/NEUTRAL AND ACID SAMPLE SUMMARY

Base/Neutral and Acids	SC-SED-30	SC-SW-30	SC-SED-11	SC-SW-11
	ug/Kg	ug/L	ug/Kg	ug/L
Phenol	ND	ND	310 J	ND
bis(2-chloroethyl)Ether	ND	ND	ND	ND
2-Chlorophenol	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	5.1	320 J	6.9
1,4-Dichlorobenzene	200 J	5.2	400 J	6.3
1,2-Dichlorobenzene	ND	2.0 J	ND	3.0 J
Benzyl alcohol	ND	ND	ND	ND
2-Methylphenol	ND	ND	ND	ND
bis(2-chloroisopropyl)Ether	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	1.0 J
n-Nitros-di-n-propylamine	ND	ND	ND	ND
Hexachloroethane	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND
Isophorone	ND	ND	ND	ND
2-Nitrophenol	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND
bis(2-chloroethoxy)Methane	ND	ND	ND	ND
2,4-Dichlorophenol	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ND	ND	ND	ND
Benzoic acid	ND	N/A	ND	N/A
Naphthalene	ND	ND	840	ND
4-Chloroaniline	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND
2-Chloro-3-methylphenol	ND	ND	ND	ND
2-Methyl naphthalene	ND	ND	ND	ND
Hexachlorocyclopentadiene	ND	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND	ND
2,4,5-Trichlorophenol	ND	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND	ND
2-Nitroaniline	ND	ND	ND	ND
Dimethyl phthalate	ND	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND
2,6-Dinitrotoluene	ND	ND	ND	ND
3-Nitroaniline	ND	ND	ND	ND
Acenaphthene	ND	ND	230 J	ND
2,4-Dinitrophenol	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	ND
Dibenzofuran	ND	ND	ND	ND
2,4-Dinitrotoluene	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND
Diethylphthalate	ND	ND	310 J	ND
4-Chlorophenyl phenyl ether	ND	ND	ND	ND
4-Nitroaniline	ND	ND	ND	ND
4,6-Dinitro-2-methylphenol	ND	ND	ND	ND
n-Nitrosodiphenylamine	ND	ND	ND	ND
SC-SED-30 is duplicate of SC-SED-10 and SC-SW-30 is a duplicate of SC-SW-10				
Due to a low level, the result is verified, but not quantified				
ND - Non-detect				

TABLE 2 - BASE/NEUTRAL AND ACID SAMPLE SUMMARY CONTINUED

Base/Neutral and Acids Cont.	SC-SED-30	SC-SW-30	SC-SED-11	SC-SW-11
	ug/Kg	ug/L	ug/Kg	ug/L
Diazene, diphenyl	ND	ND	ND	ND
4-Bromophenyl phenyl ether	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	ND
Pentachlorophenol	ND	ND	ND	ND
Phenanthrene	ND	ND	790	ND
Anthracene	ND	ND	330 J	ND
Di-n-Butyl phthalate	ND	ND	ND	ND
Fluoranthene	270 J	ND	1400	ND
Pyrene	240 J	ND	1500	ND
Butyl benzyl phthalate	ND	ND	ND	ND
Benzo(a)anthracene	ND	ND	830	ND
Chrysene	200 J	ND	1400	ND
bis(2-ethylhexyl)Phthalate	ND	ND	ND	1.0 J
Di-n-octyl phthalate	ND	ND	ND	ND
Benzo(b)fluoranthene	270 J	ND	1100	ND
Benzo(k)fluoranthene	ND	ND	450 J	ND
Benzo(a)pyrene	200 J	ND	860	ND
Indeno(1,2,3-cd)pyrene	160 J	ND	620 J	ND
Dibenzo(a,h)anthracene	ND	ND	ND	ND
Benzo(g,h,i)perylene	170 J	ND	630 J	ND
J - Due to a low level, the result is verified, but not quantified				
ND - Non-detect				
SC-SED-30 is a duplicate of SC-SED-10 and SC-SW-30 is a duplicate of SC-SW-10				

TABLE 2 - BASE/NEUTRAL AND ACID SAMPLE SUMMARY

Base/Neutral and Acids	SC-SED-12	SC-SW-12	SC-SED-13	SC-SW-13
	ug/Kg	ug/L	ug/Kg	ug/L
phenol	370 J	31	ND	ND
bis(2-chloroethyl)Ether	ND	ND	ND	ND
2-Chlorophenol	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	12	12000	6.4
1,4-Dichlorobenzene	310 J	15	18000	4.0 J
1,2-Dichlorobenzene	1000 J	58	6400	ND
Benzyl alcohol	ND	ND	ND	ND
2-Methylphenol	ND	8.5	ND	ND
bis(2-chloroisopropyl)Ether	ND	ND	ND	ND
4-Methylphenol	ND	39	ND	ND
n-Nitros-di-n-propylamine	ND	ND	ND	ND
Hexachloroethane	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND
Isophorone	ND	ND	ND	ND
2-Nitrophenol	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND
bis(2-chloroethoxy)Methane	ND	ND	ND	ND
2,4-Dichlorophenol	ND	ND	ND	ND
1,2,4-Trichlorobenzene	590 J	6.7	2500 J	ND
Benzoic acid	ND	N/A	ND	N/A
Naphthalene	3700	240	3400	ND
4-Chloroaniline	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND
Chloro-3-methylphenol	ND	ND	ND	ND
2-Methyl naphthalene	3900	80	660 J	ND
Hexachlorocyclopentadiene	ND	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND	ND
2,4,5-Trichlorophenol	ND	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND	ND
2-Nitroaniline	ND	ND	ND	ND
Dimethyl phthalate	ND	ND	ND	ND
Acenaphthylene	ND	ND	1400 J	ND
2,6-Dinitrotoluene	ND	ND	ND	ND
3-Nitroaniline	ND	ND	ND	ND
Acenaphthene	600 J	9.3	11000	ND
2,4-Dinitrophenol	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	ND
Dibenzofuran	ND	15	3000	ND
2,4-Dinitrotoluene	ND	ND	ND	ND
Fluorene	ND	2.0 J	ND	ND
Diethylphthalate	ND	ND	2600 J	ND
4-Chlorophenyl phenyl ether	ND	ND	ND	ND
4-Nitroaniline	ND	ND	ND	ND
4,6-Dinitro-2-methylphenol	ND	ND	ND	ND
n-Nitrosodiphenylamine	ND	ND	ND	ND
Due to a low level, the result is verified, but not quantified				
ND - Non-detect				

TABLE 2 - BASE/NEUTRAL AND ACID SAMPLE SUMMARY CONTINUED

Base/Neutral and Acids Cont.	SC-SED-12	SC-SW-12	SC-SED-13	SC-SW-13
	ug/Kg	ug/L	ug/Kg	ug/L
Diazene, diphenyl	ND	ND	ND	ND
4-Bromophenyl phenyl ether	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	ND
Pentachlorophenol	ND	ND	ND	ND
Phenanthrene	1200	4.9	3300	ND
Anthracene	ND	ND	2200 J	ND
Di-n-Butyl phthalate	ND	ND	ND	ND
Fluoranthene	750 J	ND	9800	ND
Pyrene	550 J	ND	9300	ND
Butyl benzyl phthalate	ND	ND	ND	ND
Benzo(a)anthracene	ND	ND	6400	ND
Chrysene	ND	ND	8200	ND
bis(2-ethylhexyl)Phthalate	ND	ND	ND	ND
Di-n-octyl phthalate	ND	ND	ND	ND
Benzo(b)fluoranthene	350 J	ND	11000	ND
Benzo(k)fluoranthene	ND	ND	3200	ND
Benzo(a)pyrene	ND	ND	7600	ND
Indeno(1,2,3-cd)pyrene	ND	ND	4800	ND
Dibenzo(a,h)anthracene	ND	ND	ND	ND
Benzo(g,h,i)perylene	ND	ND	4500	ND
J - Due to a low level, the result is verified, but not quantified				
ND - Non-detect				

TABLE 2 - BASE/NEUTRAL AND ACID SAMPLE SUMMARY

Base/Neutral and Acids	SC-SED-14	SC-SW-14	SC-SED-15	SC-SW-15
	ug/Kg	ug/L	ug/Kg	ug/L
phenol	ND	ND	ND	ND
bis(2-chloroethyl)Ether	ND	ND	ND	ND
2-Chlorophenol	ND	ND	ND	ND
1,3-Dichlorobenzene	5500	4.0 J	2900 J	3.0 J
1,4-Dichlorobenzene	8900	4.0 J	5100	3.0 J
1,2-Dichlorobenzene	3300	2.0 J	1600 J	ND
Benzyl alcohol	ND	ND	ND	ND
2-Methylphenol	ND	ND	ND	ND
bis(2-chloroisopropyl)Ether	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	ND
n-Nitros-di-n-propylamine	ND	ND	ND	ND
Hexachloroethane	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND
Isophorone	ND	ND	ND	ND
2-Nitrophenol	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND
bis(2-chloroethoxy)Methane	ND	ND	ND	ND
2,4-Dichlorophenol	ND	ND	ND	ND
1,2,4-Trichlorobenzene	1300 J	ND	ND	ND
Benzoic acid	ND	N/A	ND	N/A
Naphthalene	4900	2.0 J	2700 J	ND
4-Chloroaniline	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND
2-Chloro-3-methylphenol	ND	ND	ND	ND
2-Methyl naphthalene	ND	1.0 J	ND	ND
Hexachlorocyclopentadiene	ND	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND	ND
2,4,5-Trichlorophenol	ND	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND	ND
2-Nitroaniline	ND	ND	ND	ND
Dimethyl phthalate	ND	ND	ND	ND
Acenaphthylene	870 J	ND	1300 J	ND
2,6-Dinitrotoluene	ND	ND	ND	ND
3-Nitroaniline	ND	ND	ND	ND
Acenaphthene	1200 J	ND	1300 J	ND
2,4-Dinitrophenol	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	ND
Dibenzofuran	800 J	ND	ND	ND
2,4-Dinitrotoluene	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND
Diethylphthalate	2700 J	ND	2800 J	ND
4-Chlorophenyl phenyl ether	ND	ND	ND	ND
4-Nitroaniline	ND	ND	ND	ND
4,6-Dinitro-2-methylphenol	ND	ND	ND	ND
n-Nitrosodiphenylamine	ND	ND	ND	ND
Due to a low level, the result is verified, but not quantified				
D - Non-detect				

TABLE 2 - BASE/NEUTRAL AND ACID SAMPLE SUMMARY CONTINUED

Base/Neutral and Acids Cont.	SC-SED-14	SC-SW-14	SC-SED-15	SC-SW-15
	ug/Kg	ug/L	ug/Kg	ug/L
Diazene, diphenyl	ND	ND	ND	ND
4-Bromophenyl phenyl ether	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	ND
Pentachlorophenol	ND	ND	ND	ND
Phenanthrene	4500	ND	4300	ND
Anthracene	1600 J	ND	1700 J	ND
Di-n-Butyl phthalate	ND	ND	ND	ND
Fluoranthene	10000	ND	8800	ND
Pyrene	9800	ND	8500	ND
Butyl benzyl phthalate	ND	ND	ND	ND
Benzo(a)anthracene	6100	ND	4700	ND
Chrysene	7600	ND	6700	ND
bis(2-ethylhexyl)Phthalate	ND	1.0 J	ND	ND
Di-n-octyl phthalate	ND	ND	ND	ND
Benzo(b)fluoranthene	11000	ND	7800	ND
Benzo(k)fluoranthene	3900	ND	3100 J	ND
Benzo(a)pyrene	8100	ND	5800	ND
Indeno(1,2,3-cd)pyrene	5300	ND	3600	ND
Dibenzo(a,h)anthracene	ND	ND	ND	ND
Benzo(g,h,i)perylene	4800	ND	3300 J	ND
J - Due to a low level, the result is verified, but not quantified				
- Non-detect				



TABLE 2 - BASE/NEUTRAL AND ACID SAMPLE SUMMARY

Base/Neutral and Acids	SC-SED-16	SC-SW-16	SC-SED-17	SC-SW-17
	ug/Kg	ug/L	ug/Kg	ug/L
Phenol	ND	ND	ND	ND
bis(2-chloroethyl)Ether	ND	ND	ND	ND
2-Chlorophenol	ND	ND	ND	ND
1,3-Dichlorobenzene	9600	4.0 J	1200 J	13
1,4-Dichlorobenzene	13,000	4.2	2200	3.0 J
1,2-Dichlorobenzene	4700	ND	760 J	ND
Benzyl alcohol	ND	ND	ND	ND
2-Methylphenol	ND	ND	ND	ND
bis(2-chloroisopropyl)Ether	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	ND
n-Nitros-di-n-propylamine	ND	ND	ND	ND
Hexachloroethane	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND
Isophorone	ND	ND	ND	ND
2-Nitrophenol	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND
bis(2-chloroethoxy)Methane	ND	ND	ND	ND
2,4-Dichlorophenol	ND	ND	ND	ND
1,2,4-Trichlorobenzene	1600 J	ND	ND	ND
Benzoic acid	ND	N/A	ND	N/A
Naphthalene	5700	ND	ND	ND
4-Chloroaniline	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND
2-Chloro-3-methylphenol	ND	ND	ND	ND
1-Methyl naphthalene	ND	ND	ND	ND
Hexachlorocyclopentadiene	ND	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND	ND
2,4,5-Trichlorophenol	ND	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND	ND
2-Nitroaniline	ND	ND	ND	ND
Dimethyl phthalate	ND	ND	ND	ND
Acenaphthylene	710 J	ND	ND	ND
2,6-Dinitrotoluene	ND	ND	ND	ND
3-Nitroaniline	ND	ND	ND	ND
Acenaphthene	880 J	ND	ND	ND
2,4-Dinitrophenol	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	ND
Dibenzofuran	830 J	ND	ND	ND
2,4-Dinitrotoluene	ND	ND	ND	ND
Fluorene	620 J	ND	ND	ND
Diethylphthalate	2600	ND	ND	ND
4-Chlorophenyl phenyl ether	ND	ND	ND	ND
4-Nitroaniline	ND	ND	ND	ND
4,6-Dinitro-2-methylphenol	ND	ND	ND	ND
n-Nitrosodiphenylamine	ND	ND	ND	ND
Due to a low level, the result is verified, but not quantified				
J - Non-detect				

TABLE 2 - BASE/NEUTRAL AND ACID SAMPLE SUMMARY CONTINUED

Base/Neutral and Acids Cont.	SC-SED-16	SC-SW-16	SC-SED-17	SC-SW-17
	ug/Kg	ug/L	ug/Kg	ug/L
diazene, diphenyl	ND	ND	ND	ND
4-Bromophenyl phenyl ether	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	ND
Pentachlorophenol	ND	ND	ND	ND
Phenanthrene	4900	ND	710 J	ND
Anthracene	1800 J	ND	ND	ND
Di-n-Butyl phthalate	ND	ND	ND	ND
Fluoranthene	12000	ND	1900	ND
Pyrene	11000	ND	1800	ND
Butyl benzyl phthalate	ND	ND	390 J	ND
Benzo(a)anthracene	7600	ND	680 J	ND
Chrysene	9600	ND	910 J	ND
bis(2-ethylhexyl)Phthalate	ND	ND	1400 J	ND
Di-n-octyl phthalate	ND	ND	770 J	ND
Benzo(b)fluoranthene	12000	ND	1200 J	ND
Benzo(k)fluoranthene	4500	ND	440 J	ND
Benzo(a)pyrene	9300	ND	850 J	ND
Indeno(1,2,3-cd)pyrene	5500	ND	690 J	ND
Dibenzo(a,h)anthracene	ND	ND	ND	ND
Benzo(g,h,i)perylene	4700	ND	660 J	ND
J - Due to a low level, the result is verified, but not quantified				
- Non-detect				

TABLE 2 - BASE/NEUTRAL AND ACID SAMPLE SUMMARY

Base/Neutral and Acids	SC-SED-18	SC-SW-18	SC-SED-31	SC-SW-31
	ug/Kg	ug/L	ug/Kg	ug/L
Phenol	ND	ND	ND	ND
bis(2-chloroethyl)Ether	ND	ND	ND	ND
2-Chlorophenol	ND	ND	ND	ND
1,3-Dichlorobenzene	830 J	30	580 J	30
1,4-Dichlorobenzene	1400	11	890 J	9
1,2-Dichlorobenzene	870 J	ND	500 J	ND
Benzyl alcohol	ND	ND	ND	ND
2-Methylphenol	ND	ND	ND	ND
bis(2-chloroisopropyl)Ether	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	ND
n-Nitros-di-n-propylamine	ND	ND	ND	ND
Hexachloroethane	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND
Isophorone	ND	ND	ND	ND
2-Nitrophenol	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND
bis(2-chloroethoxy)Methane	ND	ND	ND	ND
2,4-Dichlorophenol	ND	ND	ND	ND
1,2,4-Trichlorobenzene	510 J	2.0 J	390 J	2.0 J
Benzoic acid	ND	N/A	9800	N/A
Naphthalene	970	ND	830 J	ND
4-Chloroaniline	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND
2-Chloro-3-methylphenol	ND	ND	ND	ND
1-Methyl naphthalene	ND	ND	ND	ND
Hexachlorocyclopentadiene	ND	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND	ND
2,4,5-Trichlorophenol	ND	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND	ND
2-Nitroaniline	ND	ND	ND	ND
Dimethyl phthalate	ND	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND
2,6-Dinitrotoluene	ND	ND	ND	ND
3-Nitroaniline	ND	ND	ND	ND
Acenaphthene	ND	ND	ND	ND
2,4-Dinitrophenol	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	ND
Dibenzofuran	ND	ND	ND	ND
2,4-Dinitrotoluene	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND
Diethylphthalate	ND	ND	ND	ND
4-Chlorophenyl phenyl ether	ND	ND	ND	ND
4-Nitroaniline	ND	ND	ND	ND
4,6-Dinitro-2-methylphenol	ND	ND	ND	ND
n-Nitrosodiphenylamine	ND	ND	ND	ND
SC-SED-31 is a duplicate of SC-SED-18 and SC-SW-31 is a duplicate of SC-SW-18				
Due to a low level, the result is verified, but not quantified				
- Non-detect				

TABLE 2 - BASE/NEUTRAL AND ACID SAMPLE SUMMARY CONTINUED

Base/Neutral and Acids Cont.	SC-SED-18	SC-SW-18	SC-SED-31	SC-SW-31
	ug/Kg	ug/L	ug/Kg	ug/L
Diazene, diphenyl	ND	ND	ND	ND
4-Bromophenyl phenyl ether	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	ND
Pentachlorophenol	ND	ND	ND	ND
Phenanthrene	820 J	ND	510 J	ND
Anthracene	250 J	ND	ND	ND
Di-n-Butyl phthalate	ND	ND	ND	ND
Fluoranthene	2000	ND	1100	ND
Pyrene	1800	ND	960 J	ND
Butyl benzyl phthalate	ND	ND	ND	ND
Benzo(a)anthracene	1000	ND	550 J	ND
Chrysene	1300	ND	690 J	ND
bis(2-ethylhexyl)Phthalate	2000	ND	840 J	ND
Di-n-octyl phthalate	250 J	ND	ND	ND
Benzo(b)fluoranthene	1700	ND	1000	ND
Benzo(k)fluoranthene	620 J	ND	400 J	ND
Benzo(a)pyrene	1200	ND	780 J	ND
Indeno(1,2,3-cd)pyrene	900 J	ND	710 J	ND
Dibenzo(a,h)anthracene	ND	ND	ND	ND
Benzo(g,h,i)perylene	830 J	ND	710 J	ND
J - Due to a low level, the result is verified, but not quantified				
ND - Non-detect				
-SED-31 is a duplicate of SC-SED-18 and SC-SW-31 is a duplicate of SC-SW-10				

TABLE 2 - BASE/NEUTRAL AND ACID SAMPLE SUMMARY

Base/Neutral and Acids	SC-SED-19	SC-SW-19	SC-SED-20	SC-SW-20
	ug/Kg	ug/L	ug/Kg	ug/L
Phenol	ND	1.0 J	ND	5.5
bis(2-chloroethyl)Ether	ND	ND	ND	ND
2-Chlorophenol	ND	1.0 J	ND	4.4
1,3-Dichlorobenzene	3900000	85	9300	390
1,4-Dichlorobenzene	6000000	46	21000	420
1,2-Dichlorobenzene	5300000	35	4600	450
Benzyl alcohol	ND	ND	ND	ND
2-Methylphenol	ND	ND	ND	ND
bis(2-chloroisopropyl)Ether	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	4.0 J
n-Nitros-di-n-propylamine	ND	ND	ND	ND
Hexachloroethane	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND
Isophorone	ND	ND	ND	ND
2-Nitrophenol	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND
bis(2-chloroethoxy)Methane	ND	ND	ND	ND
2,4-Dichlorophenol	ND	4.0 J	ND	5.7
1,2,4-Trichlorobenzene	2900000	4.0 J	1700	45
Benzoic acid	ND	N/A	ND	N/A
Naphthalene	23000	3.0 J	ND	23
4-Chloroaniline	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND
2-chloro-3-methylphenol	ND	ND	ND	ND
1-methyl naphthalene	31000	ND	ND	2.0 J
Hexachlorocyclopentadiene	ND	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND	ND
2,4,5-Trichlorophenol	ND	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND	ND
2-Nitroaniline	ND	ND	ND	ND
Dimethyl phthalate	ND	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND
2,6-Dinitrotoluene	ND	ND	ND	ND
3-Nitroaniline	ND	ND	ND	ND
Acenaphthene	ND	ND	ND	ND
2,4-Dinitrophenol	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	ND
Dibenzofuran	3300 J	ND	ND	ND
2,4-Dinitrotoluene	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND
Diethylphthalate	ND	ND	ND	ND
4-Chlorophenyl phenyl ether	ND	ND	ND	ND
4-Nitroaniline	ND	ND	ND	ND
4,6-Dinitro-2-methylphenol	ND	ND	ND	ND
n-Nitrosodiphenylamine	ND	ND	ND	ND
Due to a low level, the result is verified, but not quantified				
- Non-detect				

TABLE 2 - BASE/NEUTRAL AND ACID SAMPLE SUMMARY CONTINUED

Base/Neutral and Acids Cont.	SC-SED-19	SC-SW-19	SC-SED-20	SC-SW-20
	ug/Kg	ug/L	ug/Kg	ug/L
Diazene, diphenyl	ND	ND	ND	ND
4-Bromophenyl phenyl ether	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	ND
Pentachlorophenol	ND	ND	ND	ND
Phenanthrene	9600 J	ND	760 J	ND
Anthracene	ND	ND	ND	ND
Di-n-Butyl phthalate	ND	ND	ND	ND
Fluoranthene	12000 J	ND	1600 J	ND
Pyrene	10000 J	ND	1400 J	ND
Butyl benzyl phthalate	ND	ND	ND	ND
Benzo(a)anthracene	6800 J	ND	520 J	ND
Chrysene	9200 J	ND	800 J	ND
bis(2-ethylhexyl)Phthalate	21000	ND	1300 J	ND
Di-n-octyl phthalate	ND	ND	880 J	ND
Benzo(b)fluoranthene	11,000 J	ND	870 J	ND
Benzo(k)fluoranthene	3700 J	ND	ND	ND
Benzo(a)pyrene	6400 J	ND	590 J	ND
Indeno(1,2,3-cd)pyrene	5100 J	ND	460 J	ND
Dibenzo(a,h)anthracene	ND	ND	ND	ND
Benzo(g,h,i)perylene	5300 J	ND	500 J	ND
J - Due to a low level, the result is verified, but not quantified				
- Non-detect				

TABLE 2 - BASE/NEUTRAL AND ACID SAMPLE SUMMARY

Base/Neutral and Acids	SC-SED-21	SC-SW-21	RS-01
	ug/Kg	ug/L	ug/L
anol	ND	4.5	ND
bis(2-chloroethyl)Ether	ND	ND	ND
2-Chlorophenol	ND	4.0 J	ND
1,3-Dichlorobenzene	64000	430	ND
1,4-Dichlorobenzene	240000	610	ND
1,2-Dichlorobenzene	32000	190	ND
Benzyl alcohol	ND	ND	ND
2-Methylphenol	ND	ND	ND
bis(2-chloroisopropyl)Ether	ND	ND	ND
4-Methylphenol	ND	3.0 J	ND
n-Nitros-di-n-propylamine	ND	ND	ND
Hexachloroethane	ND	ND	ND
Nitrobenzene	ND	ND	ND
Isophorone	ND	ND	ND
2-Nitrophenol	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND
bis(2-chloroethoxy)Methane	ND	ND	ND
2,4-Dichlorophenol	ND	34	ND
1,2,4-Trichlorobenzene	25000	200	ND
Benzoic acid	ND	N/A	ND
Naphthalene	1100	5.6	ND
4-Chloroaniline	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND
Chloro-3-methylphenol	ND	ND	ND
-Methyl naphthalene	ND	ND	ND
Hexachlorocyclopentadiene	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND
2,4,5-Trichlorophenol	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND
2-Nitroaniline	ND	ND	ND
Dimethyl phthalate	ND	ND	ND
Acenaphthylene	ND	ND	ND
2,6-Dinitrotoluene	ND	ND	ND
3-Nitroaniline	ND	ND	ND
Acenaphthene	ND	ND	ND
2,4-Dinitrophenol	ND	ND	ND
4-Nitrophenol	ND	ND	ND
Dibenzofuran	ND	ND	ND
2,4-Dinitrotoluene	ND	ND	ND
Fluorene	ND	ND	ND
Diethylphthalate	ND	ND	ND
4-Chlorophenyl phenyl ether	ND	ND	ND
4-Nitroaniline	ND	ND	ND
4,6-Dinitro-2-methylphenol	ND	ND	ND
n-Nitrosodiphenylamine	ND	ND	ND
Due to a low level, the result is verified, but not quantified			
J - Non-detect			

TABLE 2 - BASE/NEUTRAL AND ACID SAMPLE SUMMARY CONTINUED

Base/Neutral and Acids Cont.	SC-SED-21	SC-SW-21	RB-01
	ug/Kg	ug/L	ug/L
Diazene, diphenyl	ND	ND	ND
4-Bromophenyl phenyl ether	ND	ND	ND
Hexachlorobenzene	ND	ND	ND
Pentachlorophenol	ND	ND	ND
Phenanthrene	4500	ND	ND
Anthracene	1800 J	ND	ND
Di-n-Butyl phthalate	ND	ND	ND
Fluoranthene	12000	ND	ND
Pyrene	11000	ND	ND
Butyl benzyl phthalate	ND	ND	ND
Benzo(a)anthracene	9700	ND	ND
Chrysene	11000	ND	ND
bis(2-ethylhexyl)Phthalate	1500 J	ND	ND
Di-n-octyl phthalate	ND	ND	ND
Benzo(b)fluoranthene	11,000	ND	ND
Benzo(k)fluoranthene	4300	ND	ND
Benzo(a)pyrene	6700	ND	ND
Indeno(1,2,3-cd)pyrene	3000 J	ND	ND
Dibenzo(a,h)anthracene	ND	ND	ND
Benzo(g,h,i)perylene	2300 J	ND	ND
J - Due to a low level, the result is verified, but not quantified			
N - Non-detect			



TABLE 3 - PESTICIDE AND PCB SAMPLE SUMMARY

Pesticides	SC-SED-01	SC-SW-01	SC-SED-02	SC-SW-02
	ug/Kg	ug/L	ug/Kg	ug/L
alpha-BHC	ND	ND	ND	ND
gamma-BHC	ND	ND	ND	ND
beta-BHC	ND	ND	ND	ND
delta-BHC	ND	ND	ND	ND
Heptachlor	ND	ND	ND	ND
Aldrin	ND	ND	ND	ND
Heptachlor epoxide	ND	ND	ND	ND
gamma-Chlordane	ND	ND	ND	ND
alpha-Chlordane	ND	ND	ND	ND
Endosulfan I	ND	ND	ND	ND
4,4'DDE	ND	ND	ND	ND
Dieldrin	ND	ND	ND	ND
Endrin	ND	ND	ND	ND
4,4'DDD	ND	ND	ND	0.02
Endosulfan II	ND	ND	ND	ND
4,4'DDT	ND	ND	ND	ND
Endrin aldehyde	ND	ND	ND	ND
Methoxychlor	ND	ND	ND	ND
Endosulfan sulfate	ND	ND	ND	ND
Endrin ketone	ND	ND	ND	ND
Chlordane	ND	ND	ND	ND
Toxaphene	ND	ND	ND	ND
PCBs				
	ug/Kg	ug/L	ug/Kg	ug/L
Aroclor 1016	ND	ND	ND	ND
Aroclor 1221	ND	ND	ND	ND
Aroclor 1232	ND	ND	ND	ND
Aroclor 1242	ND	ND	ND	ND
Aroclor 1248	ND	ND	ND	ND
Aroclor 1254	ND	ND	ND	ND
Aroclor 1260	ND	ND	ND	ND
ND - Non detect				

TABLE 3 - PESTICIDE AND PCB SAMPLE SUMMARY

Pesticides/PCBs	SC-SED-03	SC-SW-03	SC-SED-04	SC-SW-04
	ug/Kg	ug/L	ug/Kg	ug/L
alpha-BHC	ND	ND	ND	ND
gamma-BHC	ND	ND	ND	ND
beta-BHC	ND	ND	ND	ND
delta-BHC	ND	ND	ND	ND
Heptachlor	ND	ND	ND	ND
Aldrin	ND	ND	ND	ND
Heptachlor epoxide	ND	ND	ND	ND
gamma-Chlordane	ND	ND	ND	ND
alpha-Chlordane	ND	ND	ND	ND
Endosulfan I	ND	ND	ND	ND
4,4'DDE	ND	ND	ND	ND
Dieldrin	ND	ND	ND	ND
Endrin	ND	ND	ND	ND
4,4'DDD	ND	ND	ND	ND
Endosulfan II	ND	ND	ND	ND
4,4'DDT	ND	ND	ND	ND
Endrin aldehyde	ND	ND	ND	ND
Methoxychlor	ND	ND	ND	ND
Endosulfan sulfate	ND	ND	ND	ND
Endrin ketone	ND	ND	ND	ND
Chlordane	ND	ND	ND	ND
Toxaphene	ND	ND	ND	ND
CBs				
	ug/Kg	ug/L	ug/Kg	ug/L
Aroclor 1016	ND	ND	ND	ND
Aroclor 1221	ND	ND	ND	ND
Aroclor 1232	ND	ND	ND	ND
Aroclor 1242	ND	ND	ND	ND
Aroclor 1248	ND	ND	ND	ND
Aroclor 1254	ND	ND	ND	ND
Aroclor 1260	ND	ND	ND	ND
ND - Non detect				

TABLE 3 - PESTICIDE AND PCB SAMPLE SUMMARY

Pesticides/PCBs	SC-SED-05	SC-SW-05	SC-SED-06	SC-SW-06
	ug/Kg	ug/L	ug/Kg	ug/L
alpha-BHC	ND	ND	ND	ND
gamma-BHC	ND	ND	ND	ND
beta-BHC	21	ND	ND	ND
delta-BHC	ND	ND	ND	ND
Heptachlor	ND	ND	ND	ND
Aldrin	ND	ND	ND	ND
Heptachlor epoxide	ND	ND	ND	ND
gamma-Chlordane	ND	ND	ND	ND
alpha-Chlordane	ND	ND	ND	ND
Endosulfan I	ND	ND	ND	ND
4,4'DDE	ND	ND	ND	ND
Dieldrin	ND	ND	ND	ND
Endrin	ND	ND	ND	ND
4,4'DDD	ND	ND	ND	ND
Endosulfan II	ND	ND	ND	ND
4,4'DDT	ND	ND	ND	ND
Endrin aldehyde	ND	ND	ND	ND
Methoxychlor	ND	ND	ND	ND
Endosulfan sulfate	ND	ND	ND	ND
Endrin ketone	ND	ND	ND	ND
Chlordane	ND	ND	ND	ND
Toxaphene	ND	ND	ND	ND
PCBs				
	ug/Kg	ug/L	ug/Kg	ug/L
Aroclor 1016	ND	ND	ND	ND
Aroclor 1221	ND	ND	ND	ND
Aroclor 1232	ND	ND	ND	ND
Aroclor 1242	ND	ND	ND	ND
Aroclor 1248	ND	ND	ND	ND
Aroclor 1254	ND	ND	ND	ND
Aroclor 1260	ND	ND	ND	ND
ND - Non detect				

TABLE 3 - PESTICIDE AND PCB SAMPLE SUMMARY

Pesticides/PCBs	SC-SED-07	SC-SW-07	SC-SED-08	SC-SW-08
	ug/Kg	ug/L	ug/Kg	ug/L
alpha-BHC	ND	ND	ND	ND
gamma-BHC	ND	ND	ND	ND
beta-BHC	ND	ND	ND	ND
delta-BHC	ND	ND	ND	ND
Heptachlor	ND	ND	ND	ND
Aldrin	ND	ND	ND	ND
Heptachlor epoxide	ND	ND	ND	ND
gamma-Chlordane	ND	ND	ND	ND
alpha-Chlordane	ND	ND	ND	ND
Endosulfan I	ND	ND	ND	ND
4,4'DDE	ND	ND	3	ND
Dieldrin	ND	ND	ND	ND
Endrin	ND	ND	ND	ND
4,4'DDD	ND	ND	ND	ND
Endosulfan II	ND	ND	ND	ND
4,4'DDT	ND	ND	ND	ND
Endrin aldehyde	ND	ND	ND	ND
Methoxychlor	ND	ND	ND	ND
Endosulfan sulfate	ND	ND	ND	ND
Endrin ketone	ND	ND	ND	ND
Chlordane	ND	ND	ND	ND
Toxaphene	ND	ND	ND	ND
PCBs				
	ug/Kg	ug/L	ug/Kg	ug/L
Aroclor 1016	ND	ND	ND	ND
Aroclor 1221	ND	ND	ND	ND
Aroclor 1232	ND	ND	ND	ND
Aroclor 1242	ND	ND	ND	ND
Aroclor 1248	ND	ND	ND	ND
Aroclor 1254	ND	ND	ND	ND
Aroclor 1260	ND	ND	ND	ND
ND - Non detect				

TABLE 3 - PESTICIDE AND PCB SAMPLE SUMMARY

Pesticides/PCBs	SC-SED-09	SC-SW-09	SC-SED-10	SC-SW-10
	ug/Kg	ug/L	ug/Kg	ug/L
alpha-BHC	ND	ND	ND	ND
gamma-BHC	ND	ND	ND	ND
beta-BHC	ND	ND	ND	ND
delta-BHC	ND	ND	ND	ND
Heptachlor	ND	ND	ND	ND
Aldrin	ND	ND	ND	ND
Heptachlor epoxide	ND	ND	ND	ND
gamma-Chlordane	ND	ND	ND	ND
alpha-Chlordane	ND	ND	ND	ND
Endosulfan I	ND	ND	ND	ND
4,4'DDE	8	ND	ND	ND
Dieldrin	ND	ND	ND	ND
Endrin	ND	ND	ND	ND
4,4'DDD	ND	ND	ND	ND
Endosulfan II	ND	ND	ND	ND
4,4'DDT	ND	ND	ND	ND
Endrin aldehyde	ND	ND	ND	ND
Methoxychlor	ND	ND	ND	ND
Endosulfan sulfate	ND	ND	ND	ND
Endrin ketone	ND	ND	ND	ND
Chlordane	ND	ND	ND	ND
Toxaphene	ND	ND	ND	ND
PCBs				
	ug/Kg	ug/L	ug/Kg	ug/L
Aroclor 1016	ND	ND	ND	ND
Aroclor 1221	ND	ND	ND	ND
Aroclor 1232	ND	ND	ND	ND
Aroclor 1242	ND	ND	ND	ND
Aroclor 1248	ND	ND	ND	ND
Aroclor 1254	ND	ND	ND	ND
Aroclor 1260	ND	ND	ND	ND
ND - Non detect				

TABLE 3 - PESTICIDE AND PCB SAMPLE SUMMARY

Pesticides/PCBs	SC-SED-30	SC-SW-30	SC-SED-11	SC-SW-11
	ug/Kg	ug/L	ug/Kg	ug/L
alpha-BHC	ND	ND	ND	ND
gamma-BHC	ND	ND	ND	ND
beta-BHC	ND	ND	ND	ND
delta-BHC	ND	ND	ND	ND
Heptachlor	ND	ND	ND	ND
Aldrin	ND	ND	ND	ND
Heptachlor epoxide	ND	ND	ND	ND
gamma-Chlordane	ND	ND	ND	ND
alpha-Chlordane	ND	ND	ND	ND
Endosulfan I	ND	ND	ND	ND
4,4'DDE	ND	ND	ND	ND
Dieldrin	ND	ND	ND	ND
Endrin	ND	ND	ND	ND
4,4'DDD	ND	ND	ND	ND
Endosulfan II	ND	ND	ND	ND
4,4'DDT	ND	ND	ND	ND
Endrin aldehyde	ND	ND	ND	ND
Methoxychlor	ND	ND	ND	ND
Endosulfan sulfate	ND	ND	ND	ND
Endrin ketone	ND	ND	ND	ND
Chlordane	ND	ND	ND	ND
Toxaphene	ND	ND	ND	ND
PCBs				
	ug/Kg	ug/L	ug/Kg	ug/L
Aroclor 1016	ND	ND	ND	ND
Aroclor 1221	ND	ND	ND	ND
Aroclor 1232	ND	ND	ND	ND
Aroclor 1242	ND	ND	ND	ND
Aroclor 1248	ND	ND	ND	ND
Aroclor 1254	ND	ND	ND	ND
Aroclor 1260	ND	ND	ND	ND
ND - Non detect				
SC-SED-30 is a duplicate of SC-SED-10 and SC-SW-30 is a duplicate of SC-SW-10				

TABLE 3 - PESTICIDE AND PCB SAMPLE SUMMARY

Pesticides/PCBs	SC-SED-12	SC-SW-12	SC-SED-13	SC-SW-13
	ug/Kg	ug/L	ug/Kg	ug/L
alpha-BHC	ND	ND	ND	ND
gamma-BHC	ND	ND	ND	ND
beta-BHC	ND	ND	73	ND
delta-BHC	ND	ND	ND	ND
Heptachlor	ND	ND	ND	ND
Aldrin	ND	ND	ND	ND
Heptachlor epoxide	ND	ND	ND	ND
gamma-Chlordane	ND	ND	ND	ND
alpha-Chlordane	ND	ND	ND	ND
Endosulfan I	ND	ND	ND	ND
4,4'DDE	ND	ND	30	ND
Dieldrin	ND	ND	ND	ND
Endrin	ND	ND	ND	ND
4,4'DDD	ND	ND	ND	ND
Endosulfan II	ND	ND	ND	ND
4,4'DDT	ND	ND	ND	ND
Endrin aldehyde	ND	ND	ND	ND
Methoxychlor	ND	ND	ND	ND
Endosulfan sulfate	ND	ND	ND	ND
Endrin ketone	ND	ND	ND	ND
Chlordane	ND	ND	ND	ND
Toxaphene	ND	ND	ND	ND
PCBs				
	ug/Kg	ug/L	ug/Kg	ug/L
Aroclor 1016	ND	ND	ND	ND
Aroclor 1221	ND	ND	ND	ND
Aroclor 1232	ND	ND	ND	ND
Aroclor 1242	ND	ND	ND	ND
Aroclor 1248	ND	ND	ND	ND
Aroclor 1254	ND	ND	1900	ND
Aroclor 1260	ND	ND	ND	ND
ND - Non detect				

TABLE 3 - PESTICIDE AND PCB SAMPLE SUMMARY

Pesticides/PCBs	SC-SED-14	SC-SW-14	SC-SED-15	SC-SW-15
	ug/Kg	ug/L	ug/Kg	ug/L
alpha-BHC	ND	ND	ND	ND
gamma-BHC	ND	ND	ND	ND
beta-BHC	ND	ND	ND	ND
delta-BHC	ND	ND	ND	ND
Heptachlor	ND	ND	ND	ND
Aldrin	ND	ND	ND	ND
Heptachlor epoxide	22	ND	ND	ND
gamma-Chlordane	ND	ND	ND	ND
alpha-Chlordane	ND	ND	ND	ND
Endosulfan I	ND	ND	ND	ND
4,4'DDE	ND	ND	ND	ND
Dieldrin	67	ND	64	ND
Endrin	ND	ND	89	ND
4,4'DDD	ND	ND	ND	ND
Endosulfan II	ND	ND	ND	ND
4,4'DDT	ND	ND	40	ND
Endrin aldehyde	ND	ND	ND	ND
Methoxychlor	ND	ND	ND	ND
Endosulfan sulfate	ND	ND	ND	ND
Endrin ketone	ND	ND	ND	ND
Chlordane	ND	ND	ND	ND
Toxaphene	ND	ND	ND	ND
PCBs				
	ug/Kg	ug/L	ug/Kg	ug/L
Aroclor 1016	ND	ND	ND	ND
Aroclor 1221	ND	ND	ND	ND
Aroclor 1232	ND	ND	ND	ND
Aroclor 1242	ND	ND	ND	ND
Aroclor 1248	ND	ND	ND	ND
Aroclor 1254	ND	ND	ND	ND
Aroclor 1260	ND	ND	ND	ND
ND - Non detect				



TABLE 3 - PESTICIDE AND PCB SAMPLE SUMMARY

Pesticides/PCBs	SC-SED-16	SC-SW-16	SC-SED-17	SC-SW-17
	ug/Kg	ug/L	ug/Kg	ug/L
alpha-BHC	ND	ND	ND	ND
gamma-BHC	ND	ND	ND	ND
beta-BHC	ND	ND	31	ND
delta-BHC	ND	ND	ND	ND
Heptachlor	ND	ND	ND	ND
Aldrin	ND	ND	ND	ND
Heptachlor epoxide	ND	ND	ND	ND
gamma-Chlordane	ND	ND	ND	ND
alpha-Chlordane	ND	ND	ND	ND
Endosulfan I	ND	ND	ND	ND
4,4'DDE	ND	ND	ND	ND
Dieldrin	ND	ND	ND	ND
Endrin	ND	ND	ND	ND
4,4'DDD	ND	ND	ND	ND
Endosulfan II	ND	ND	ND	ND
4,4'DDT	ND	ND	ND	ND
Endrin aldehyde	ND	ND	ND	ND
Methoxychlor	ND	ND	ND	ND
Endosulfan sulfate	ND	ND	ND	ND
Endrin ketone	ND	ND	ND	ND
Chlordane	ND	ND	ND	ND
Toxaphene	ND	ND	ND	ND
PCBs				
	ug/Kg	ug/L	ug/Kg	ug/L
Aroclor 1016	ND	ND	ND	ND
Aroclor 1221	ND	ND	ND	ND
Aroclor 1232	ND	ND	ND	ND
Aroclor 1242	ND	ND	ND	ND
Aroclor 1248	ND	ND	ND	ND
Aroclor 1254	240	ND	ND	ND
Aroclor 1260	ND	ND	ND	ND
ND - Non detect				

TABLE 3 - PESTICIDE AND PCB SAMPLE SUMMARY

Pesticides/PCBs	SC-SED-18	SC-SW-18	SC-SED-31	SC-SW-31
	ug/Kg	ug/L	ug/Kg	ug/L
alpha-BHC	ND	ND	ND	ND
gamma-BHC	ND	ND	ND	ND
beta-BHC	15	ND	ND	ND
delta-BHC	ND	ND	ND	ND
Heptachlor	ND	ND	ND	ND
Aldrin	ND	ND	ND	ND
Heptachlor epoxide	ND	ND	ND	ND
gamma-Chlordane	ND	ND	ND	ND
alpha-Chlordane	ND	ND	ND	ND
Endosulfan I	ND	ND	ND	ND
4,4'DDE	ND	ND	ND	ND
Dieldrin	ND	ND	ND	ND
Endrin	ND	ND	ND	ND
4,4'DDD	ND	ND	ND	ND
Endosulfan II	ND	ND	ND	ND
4,4'DDT	ND	ND	ND	ND
Endrin aldehyde	ND	ND	ND	ND
Methoxychlor	ND	ND	ND	ND
Endosulfan sulfate	ND	ND	ND	ND
Endrin ketone	ND	ND	ND	ND
Chlordane	ND	ND	ND	ND
Toxaphene	ND	ND	ND	ND
CBs				
	ug/Kg	ug/L	ug/Kg	ug/L
Aroclor 1016	ND	ND	ND	ND
Aroclor 1221	ND	ND	ND	ND
Aroclor 1232	ND	ND	ND	ND
Aroclor 1242	ND	ND	ND	ND
Aroclor 1248	ND	ND	ND	ND
Aroclor 1254	ND	ND	51	ND
Aroclor 1260	ND	ND	ND	ND
ND - Non detect				
SC-SED-31 is a duplicate of SC-SED-18 and SC-SW-31 is a duplicate of SC-SW-18				

TABLE 3 - PESTICIDE AND PCB SAMPLE SUMMARY

Pesticides/PCBs	SC-SED-19	SC-SW-19	SC-SED-20	SC-SW-20
	ug/Kg	ug/L	ug/Kg	ug/L
alpha-BHC	ND	ND	ND	ND
gamma-BHC	ND	ND	ND	ND
beta-BHC	ND	ND	13	ND
delta-BHC	ND	ND	ND	ND
Heptachlor	ND	ND	ND	ND
Aldrin	ND	ND	ND	ND
Heptachlor epoxide	ND	ND	ND	ND
gamma-Chlordane	ND	ND	ND	ND
alpha-Chlordane	ND	ND	ND	ND
Endosulfan I	ND	ND	ND	ND
4,4'DDE	ND	ND	ND	ND
Dieldrin	ND	ND	ND	ND
Endrin	ND	ND	ND	ND
4,4'DDD	ND	ND	ND	ND
Endosulfan II	ND	ND	ND	ND
4,4'DDT	ND	ND	ND	ND
Endrin aldehyde	ND	ND	ND	ND
Methoxychlor	ND	ND	ND	ND
Endosulfan sulfate	ND	ND	ND	ND
Endrin ketone	37	ND	ND	ND
Chlordane	ND	ND	ND	ND
Toxaphene	ND	ND	ND	ND
PCBs				
	ug/Kg	ug/L	ug/Kg	ug/L
Aroclor 1016	ND	ND	ND	ND
Aroclor 1221	ND	ND	ND	ND
Aroclor 1232	ND	ND	ND	ND
Aroclor 1242	ND	ND	ND	ND
Aroclor 1248	ND	ND	ND	ND
Aroclor 1254	710	ND	ND	ND
Aroclor 1260	ND	ND	ND	ND
ND - Non detect				

TABLE 3 - PESTICIDE AND PCB SAMPLE SUMMARY

Pesticides/PCBs	SC-SED-21	SC-SW-21	RB-01
	ug/Kg	ug/L	ug/L
alpha-BHC	ND	ND	ND
gamma-BHC	ND	ND	ND
beta-BHC	ND	ND	ND
delta-BHC	ND	ND	ND
Heptachlor	ND	ND	ND
Aldrin	ND	ND	ND
Heptachlor epoxide	ND	ND	ND
gamma-Chlordane	ND	ND	ND
alpha-Chlordane	ND	ND	ND
Endosulfan I	ND	ND	ND
4,4'DDE	28	ND	ND
Dieldrin	ND	ND	ND
Endrin	ND	ND	ND
4,4'DDD	ND	ND	ND
Endosulfan II	ND	ND	ND
4,4'DDT	ND	ND	ND
Endrin aldehyde	ND	ND	ND
Methoxychlor	ND	ND	ND
Endosulfan sulfate	ND	ND	ND
Endrin ketone	ND	ND	ND
Chlordane	ND	ND	ND
Toxaphene	ND	ND	ND
PCBs			
	ug/Kg	ug/L	ug/L
Aroclor 1016	ND	ND	ND
Aroclor 1221	ND	ND	ND
Aroclor 1232	ND	ND	ND
Aroclor 1242	ND	ND	ND
Aroclor 1248	ND	ND	ND
Aroclor 1254	ND	ND	ND
Aroclor 1260	ND	ND	ND
ND - Non detect			

TABLE 4 - CHLORINATED DIBENZO-P-DIOXINS AND DIBENZOFURAN SAMPLE SUMMARY

Dioxins and Furans	SC-SED-01	SC-SED-02	SC-SED-03	SC-SED-04
	ng/kg	ng/kg	ng/kg	ng/kg
	Diluted sample			
2378-TCDD	39.8	96.1	89.8	7.86
2378-TCDF	55.9	93.7	101	13.8
12378-PeCDF	10.1	13	14.4	2.4
12378-PeCDD	6.31	8.02 X	9.58	0.848 X
23478-PeCDF	28.4	60.2	60	9.89 J
123478-HxCDF	236	525	548	99.7
123678-HxCDF	42	76.2	80	14.3
123478-HxCDD	4.68	4.62 X	8.71	1.07
123678-HxCDD	9.84	18.5	24.9	2.74
123789-HxCDD	8.27	13.9	- 15.3	1.8
234678-HxCDF	17.3	44.6	41.3	5.21 J
123789-HxCDF	ND	ND	ND	ND
1234678-HpCDF	881	1860	1600	318
1234678-HpCDD	102	218	244	23.6
1234789-HpCDF	24.3	62.1	52	10 J
OCDD	1430	2820	2700	257
OCDF	1060	2950	2670	487
Total Dioxins				
Total TCDD	68.5	231	225	28.2
Total PeCDD	25.5	48.2	53.3	11.6
Total HxCDD	107	152	220	13.2
Total HpCDD	243	590	612	57
Total Furans				
Total TCDF	294	296	499	64.1
Total PeCDF	233	544	575	86.4
Total HxCDF	623	1030	1160	204
Total HpCDF	1030	2140	1980	357
X - The result is estimated because at a low level, the GC/MS was unable to give an exact positive identification of the compound.				
J - The results were less than 5 times the concentration of the compound in the rinsate blank and were therefore, estimated.				
ND - Non detect				

TABLE 4 - CHLORINATED DIBENZO-P-DIOXINS AND DIBENZOFURAN SAMPLE SUMMARY

Dioxins and Furans	SC-SED-05	SC-SED-06	SC-SED-07	SC-SED-08
	ng/kg	ng/kg	ng/kg	ng/kg
	Diluted	Diluted	Diluted	Diluted
2378-TCDD	14.6	6.33	4.99	ND
2378-TCDF	307	361	377	389
12378-PeCDF	104	76.8	95.3	116
12378-PeCDD	23.7	18.3	10.3 X	15.5 X
23478-PeCDF	647	460	557	641
123478-HxCDF	9850	4880	7650	9090
123678-HxCDF	1450	634	993	1080
123478-HxCDD	24.6	12.1	14.4	19.1
123678-HxCDD	49.8	41.3	48.3	55.5
123789-HxCDD	23.8	19.5 X	20	25.2
234678-HxCDF	605	291	505	613
123789-HxCDF	ND	ND	ND	ND
1234678-HpCDF	34,100	16,100	24,300	31,400
1234678-HpCDD	206	252	133	231
1234789-HpCDF	1000	486	737	859
OCDD	1630	2170	1380	2300
OCDF	65,300	24,300	38,100	47,900
Total Dioxins				
Total TCDD	153	167	182	244
Total PeCDD	156	161	74.9	193
Total HxCDD	178	260	160	385
Total HpCDD	413	498	286	487
Total Furans				
Total TCDF	1690	2570	2950	4060
Total PeCDF	5060	3990	5630	6140
Total HxCDF	18,000	9740	15,600	17,900
Total HpCDF	38,600	18,500	28,100	35,700
X - The result is estimated because at a low level, the GC/MS was unable to give an exact positive identification of the compound.				
ND - Non detect				

TABLE 4 - CHLORINATED DIBENZO-P-DIOXINS AND DIBENZOFURAN SAMPLE SUMMARY

Dioxins and Furans	SC-SED-09	SC-SED-10	SC-SED-30	SC-SED-11
	ng/kg	ng/kg	ng/kg	ng/kg
	Diluted	Diluted	Diluted	Diluted
2378-TCDD	5.1	6.95	ND	1.53
2378-TCDF	200	49.2	49.3	41.3
12378-PeCDF	84.8	16.5	15.4	18.9
12378-PeCDD	9.86	1.98	ND	1.93 X
23478-PeCDF	364	81.7	80.1	62.7
123478-HxCDF	4330	952	872	587
123678-HxCDF	604	130	127	102
123478-HxCDD	14.3	3.08	1.94	1.93
123678-HxCDD	39.6	7.22	6.95	4.43
123789-HxCDD	20.3	2.42 X	2.97 X	4.79
234678-HxCDF	283	63.3	77.8	57.8
123789-HxCDF	ND	ND	ND	ND
1234678-HpCDF	13,400	3,330	2,820	1,900
1234678-HpCDD	799	46.1	52.3	47.2
1234789-HpCDF	378	84.3	77	50.4
OCDD	13,700	517	463	395
OCDF	21,000	5,680	4,070	2,910
Total Dioxins				
Total TCDD	117	11	15.7	23.9
Total PeCDD	100	10.3	ND	5.81
Total HxCDD	148	38	41.4	31.7
Total HpCDD	1650	109	127	101
Total Furans				
Total TCDF	1410	322	307	261
Total PeCDF	3190	733	711	480
Total HxCDF	8,810	2010	1,780	1,150
Total HpCDF	15,300	3,670	3,140	2,270
X - The result is estimated because at a low level, the GC/MS was unable to give an exact positive identification of the compound.				
ND - Non detect				
SCD30 is a blind duplicate of SCD10				

TABLE 4 - CHLORINATED DIBENZO-P-DIOXINS AND DIBENZOFURAN SAMPLE SUMMARY

Dioxins and Furans	SC-SED-12	SC-SED-13	SC-SED-14	SC-SED-15
	ng/kg	ng/kg	ng/kg	ng/kg
	Diluted	Diluted	Diluted	Diluted
2378-TCDD	2.01	96.4	81	91.7
2378-TCDF	47.4	1140	1420	911
12378-PeCDF	26.9	397	525	334
12378-PeCDD	1.71 X	58.9	55.2	43.4
23478-PeCDF	108	1430	1430	1010
123478-HxCDF	1350	18,500	17,800	12,100
123678-HxCDF	206	2670	2670	1980
123478-HxCDD	3.28	70.1	57.3	46.2
123678-HxCDD	8.22	152	157	119
123789-HxCDD	5.05	58.3	98.9	72.2
234678-HxCDF	101	1260	859	748
123789-HxCDF	ND	ND	51.2	43.1
1234678-HpCDF	4,660	52,400	51,400	38,200
1234678-HpCDD	63.7	917	902	733
1234789-HpCDF	120	1540	1690	1050
OCDD	394	9550	9750	960
OCDF	6,170	74,500	79,700	66,600
Total Dioxins				
Total TCDD	26.8	669	677	535
Total PeCDD	11.8	576	525	450
Total HxCDD	37	1200	1270	757
Total HpCDD	144	2010	1890	1540
Total Furans				
Total TCDF	334	14,300	18,100	8320
Total PeCDF	1000	17,300	19,300	11,500
Total HxCDF	2,870	37,900	36,900	24,700
Total HpCDF	5,370	59,400	58,500	42,800
X - The result is estimated because at a low level, the GC/MS was unable to give an exact positive identification of the compound.				
ND - Non detect				



TABLE 4 - CHLORINATED DIBENZO-P-DIOXINS AND DIBENZOFURAN SAMPLE SUMMARY

Dioxins and Furans	SC-SED-16	SC-SED-17	SC-SED-18	SC-SED-31
	ng/kg	ng/kg	ng/kg	ng/kg
	Diluted	Diluted	Diluted	Diluted
2378-TCDD	50	8.83	6.12	3.27 X
2378-TCDF	668	153	72.6	77.2
12378-PeCDF	234	94.8	39.1	36.1
12378-PeCDD	58.9	15.8 X	6.96 X	10.1 X
23478-PeCDF	668	221	116	115
123478-HxCDF	5110	2,430	1,190	1,190
123678-HxCDF	947	392	191	177
123478-HxCDD	41.3	12	7.66	23.4
123678-HxCDD	110	28.5	16	22.3
123789-HxCDD	97.3	28.3	14 X	35.6 X
234678-HxCDF	537	188	80.5	89.2
123789-HxCDF	25.2	9.82	4.66	ND
1234678-HpCDF	20,200	9,510	4,360	3,660
1234678-HpCDD	976	201	139	159
1234789-HpCDF	548	246	104	113
OCDD	10,000	1810	1250	1270
OCDF	26,000	13,300	5,330	6,710
Total Dioxins				
Total TCDD	558	173	75.4	67.5
Total PeCDD	621	135	ND	66.3
Total HxCDD	952	207	95.6	227
Total HpCDD	2610	518	371	382
Total Furans				
Total TCDF	7680	1,330	783	587
Total PeCDF	8530	2,290	1,180	1,080
Total HxCDF	11,800	5,160	2,520	2,130
Total HpCDF	22,900	10,700	4,820	4,080
X - The result is estimated because at a low level, the GC/MS was unable to give an exact positive identification of the compound.				
ND - Non detect				
SCD31 is a blind duplicate of SCD18				

TABLE 4 - CHLORINATED DIBENZO-P-DIOXINS AND DIBENZOFURAN SAMPLE SUMMARY

Dioxins and Furans	SC-SED-19	SC-SED-20	SC-SED-21	RB01
	ng/kg	ng/kg	ng/kg	ng/kg
	Diluted	Diluted	Diluted	
2378-TCDD	85.1	ND	21.7	ND
2378-TCDF	594	15.2	414	ND
12378-PeCDF	186	7.43	154	1.91 X
12378-PeCDD	46.7	ND	31.9	ND
23478-PeCDF	582	16.1	517	3.11
123478-HxCDF	7240	178	6,700	1.25 X
123678-HxCDF	1340	31.1	1170	2.54
23478-HxCDD	43.5	4.59	29.8	ND
23678-HxCDD	107	5.06	72.4	2.92 X
23789-HxCDD	84	4.96	46.9	ND
34678-HxCDF	730	18.5	640	2.43
23789-HxCDF	18.3	ND	ND	1.80 X
234678-HpCDF	27,200	568	28,800	2.19 X
234678-HpCDD	829	83.8	459	2.95 X
234789-HpCDF	617	13.8 X	790	2.09 B
CDD	9,550	1080	4470	10.9 X
CDF	28,000	825	44,000	4.72 X
Total Dioxins				
Total TCDD	796	13.9	574	ND
Total PeCDD	508	18.1	455	ND
Total CDD	1020	65.3	647	ND
Total CDD	1600	425	994	ND
Total Furans				
Total TCDF	6170	138	4,150	ND
Total PeCDF	8270	160	5,330	3.11
Total HxCDF	17,300	383	16,200	4.96
Total HpCDF	30,500	634	32,900	2.09
The result is estimated because at a low level, the GC/MS was unable to give an exact positive identification of the compound.				
- Non detect				
Results were outside of quality assurance limits.				

TABLE 5 - TOTAL METAL AND TOTAL ORGANIC CARBON SAMPLE SUMMARY

p/m

Total Metals	SC-SED-01	SC-SW-01	SC-SED-02	SC-SW-02
	mg/Kg	ug/L	mg/Kg	ug/L
Aluminum	8900	67,000	12,000	5500
Antimony	3.8	15	3.3	ND
Arsenic	20	73	12	ND
Barium	93	390	78	120
Beryllium	0.59	ND	0.77	ND
Cadmium	1.7	9.3	1.4	ND
Calcium	3400	200	6400	180
Chromium	570	3000	510	280
Cobalt	9.4	62	11	ND
Copper	100	460	99	ND
Iron	21,000	160,000	30,000	18,000
Lead	160	540	110	ND
Magnesium	5100	600	8300	250
Manganese	260	3300	430	920
Nickel	31	200	35	17
Mercury	1.7	8.8	0.44	ND
Potassium	1600	180	2300	100
Selenium	0.77	ND	ND	ND
Silver	1.3	8.1	1.8	ND
Sodium	4300	5000	10,000	2100
Thallium	ND	ND	ND	ND
Vanadium	36	250	38	ND
Zinc	210	1100	210	ND
Total Organic Carbon	39,000	N/A	53,000	N/A
ND - Non detect				

TABLE 5 - TOTAL METAL AND TOTAL ORGANIC CARBON SAMPLE SUMMARY

Total Metals	SC-SED-03	SC-SW-03	SC-SED-04	SC-SW-04
	mg/Kg	ug/L	mg/Kg	ug/L
Aluminum	11,000	10,000	12,000	1200
Antimony	2.7	ND	20	ND
Arsenic	12	ND	21	ND
Barium	77	150	58	58
Beryllium	0.73	ND	ND	ND
Cadmium	1.1	ND	0.65	ND
Calcium	5800	190	29,000	160
Chromium	410	390	3800	24
Cobalt	11	8.7	71	ND
Copper	89	31	17	ND
Iron	29,000	29,000	52,000	2400
Lead	97	29	48	ND
Magnesium	7800	270	21,000	490
Manganese	440	1100	740	310
Nickel	34	24	260	5.7
Mercury	0.59	0.49	0.25	0.066
Potassium	2100	100	470	150
Selenium	0.74	ND	ND	ND
Silver	1.7	ND	ND	ND
Sodium	8200	2300	3700	4000
Thallium	ND	ND	ND	ND
Vanadium	36	22	720	ND
nc	190	86	210	ND
Total Organic Carbon	39,000	N/A	5500	N/A
ND - Non detect				

TABLE 5 - TOTAL METAL AND TOTAL ORGANIC CARBON SAMPLE SUMMARY

Total Metals	SC-SED-05	SC-SW-05	SC-SED-06	SC-SW-06
	mg/Kg	ug/L	mg/Kg	ug/L
Aluminum	4700	8,400	1000	760
Antimony	4.4	ND	4.2	ND
Arsenic	9.3	ND	4.4	ND
Barium	190	260	160	620
Beryllium	ND	ND	ND	ND
Cadmium	0.83	ND	ND	ND
Calcium	210,000	290	280,000	810
Chromium	790	1300	740	1900
Cobalt	4.9	11	2.9	ND
Copper	26	21	9.3	11
Iron	42,000	39,000	2,400	980
Lead	38	65	59	25
Magnesium	18,000	500	20,000	12
Manganese	1300	1300	180	60
Nickel	17	39	30	14
Mercury	0.46	0.31	0.51	0.62
Potassium	990	150	ND	8.2
Selenium	ND	ND	ND	ND
Silver	ND	ND	ND	ND
Sodium	13,000	3900	860	110
Thallium	ND	ND	ND	ND
Vanadium	37	74	30	33
Zinc	92	220	56	40
Total Organic Carbon	29,000	N/A	15,000	N/A
ND - Non detect				

TABLE 5 - TOTAL METAL AND TOTAL ORGANIC CARBON SAMPLE SUMMARY

al Metals	SC-SED-07	SC-SW-07	SC-SED-08	SC-SW-08
	mg/Kg	ug/L	mg/Kg	ug/L
Aluminum	11,000	ND	4,100	ND
Antimony	4.6	ND	9.5	ND
Arsenic	2.7	ND	6.2	ND
Barium	62	98	210	69
Beryllium	ND	ND	ND	ND
Cadmium	0.46	ND	0.43	ND
Calcium	59,000	92	240,000	50
Chromium	790	1400	1600	1100
Cobalt	26	ND	22	ND
Copper	130	ND	73	ND
Iron	23,000	240	14,000	200
Lead	26	ND	200	26
Magnesium	13,000	11	10,000	6
Manganese	240	11	370	13
Nickel	650	8.2	310	8.6
Mercury	5.1	0.086	4.3	0.49
Potassium	520	16	210	13
Selenium	ND	ND	ND	ND
Silver	ND	ND	ND	ND
Sodium	1700	220	1400	180
Strontium	ND	ND	ND	ND
Radium	100	120	150	81
Zinc	160	ND	140	9.6
Total Organic Carbon	25,000	N/A	27,000	N/A
ND - Non detect				

TABLE 5 - TOTAL METAL AND TOTAL ORGANIC CARBON SAMPLE SUMMARY

Total Metals	SC-SED-09	SC-SW-09	SC-SED-10	SC-SW-10
	mg/Kg	ug/L	mg/Kg	ug/L
Aluminum	5300	ND	19,000	ND
Antimony	11	ND	57	ND
Arsenic	2.5	ND	2.4	ND
Barium	260	160	110	46
Beryllium	ND	ND	ND	ND
Cadmium	ND	ND	0.47	ND
Calcium	220,000	89	210,000	35
Chromium	2000	710	11,000	230
Cobalt	32	ND	64	ND
Copper	74	ND	12	ND
Iron	22,000	580	35,000	870
Lead	540	200	110	80
Magnesium	25,000	6.4	40,000	8.3
Manganese	600	42	570	81
Nickel	170	7	360	5.1
Mercury	24	8.3	0.22	ND
Potassium	300	6.3	ND	6.1
Selenium	ND	ND	ND	ND
Silver	ND	ND	ND	ND
Sodium	740	57	560	51
Thallium	ND	ND	ND	ND
Titanium	310	ND	280	ND
Zinc	120	ND	110	8.6
Total Organic Carbon	18,000	N/A	11,000	N/A
ND - Non detect				

TABLE 5 - TOTAL METAL AND TOTAL ORGANIC CARBON SAMPLE SUMMARY

Metals	SC-SED-30	SC-SW-30	SC-SED-11	SC-SW-11
	mg/Kg	ug/L	mg/Kg	ug/L
Aluminum	2,700	ND	1,500	410
Antimony	11	ND	8.6	ND
Arsenic	2.9	ND	1.6	ND
Barium	360	36	300	140
Beryllium	ND	ND	ND	ND
Cadmium	2	ND	ND	ND
Calcium	260,000	26	310,000	150
Chromium	1,500	200	1400	450
Cobalt	4.4	ND	3.9	ND
Copper	35	ND	16	ND
Iron	12,000	680	5,400	2,200
Lead	3300	61	880	330
Magnesium	7,200	8.1	12,000	11
Manganese	1400	58	780	220
Nickel	14	ND	24	7
Mercury	0.26	ND	0.14	ND
Potassium	170	6	110	6.2
Selenium	ND	ND	ND	ND
Silver	ND	ND	ND	ND
Sodium	1200	50	1600	50
Thallium	ND	ND	ND	ND
Radium	39	ND	21	10
Vanadium	960	ND	71	40
Total Organic Carbon	15,000	N/A	14,000	N/A
ND - Non detect				
SC-SEC-30 is a duplicate of SC-SED-10 and SC-SW-30 is a duplicate of SC-SW-10				



TABLE 5 - TOTAL METAL AND TOTAL ORGANIC CARBON SAMPLE SUMMARY

Total Metals	SC-SED-12	SC-SW-12	SC-SED-13	SC-SW-13
	mg/Kg	ug/L	mg/Kg	ug/L
Aluminum	1,600	1500	12,000	250
Antimony	8.9	17	38	ND
Arsenic	1.1	ND	17	ND
Barium	180	250	15	50
Beryllium	ND	ND	0.6	ND
Cadmium	ND	ND	5	ND
Calcium	63,000	390	53,000	31
Chromium	1500	3300	5300	250
Cobalt	1.7	ND	19	ND
Copper	11	ND	170	ND
Iron	4,100	1200	57,000	1,700
Lead	430	210	10,000	420
Magnesium	15,000	7.1	6,000	12
Manganese	660	200	520	72
Nickel	7.2	ND	99	7.3
Mercury	0.088	ND	0.016	0.11
Potassium	ND	4.3	750	6.9
Selenium	ND	ND	1.8	ND
Silver	ND	ND	1.5	ND
Sodium	1000	69	1,500	53
Strontium	ND	ND	2.4	ND
Titanium	15	ND	200	12
Zinc	71	22	1500	29
Total Organic Carbon	12,000	N/A	130,000	N/A
ND - Non detect				

TABLE 5 - TOTAL METAL AND TOTAL ORGANIC CARBON SAMPLE SUMMARY

Total Metals	SC-SED-14	SC-SW-14	SC-SED-15	SC-SW-15
	mg/Kg	ug/L	mg/Kg	ug/L
Aluminum	12,000	ND	12,000	330
Antimony	37	ND	45	ND
Arsenic	20	ND	18	ND
Barium	18	18	35	68
Beryllium	0.72	ND	0.61	ND
Cadmium	4.5	ND	4.5	ND
Calcium	14,000	21	20,000	25
Chromium	5,100	150	7400	240
Cobalt	18	ND	17	ND
Copper	250	ND	250	10
Iron	81,000	880	65,000	3,000
Lead	3700	76	5200	240
Magnesium	3,800	10	4,700	11
Manganese	590	56	450	110
Nickel	91	ND	81	6.3
Mercury	0.022	ND	0.091	0.056
Potassium	1100	6.5	1200	6.7
Selenium	2.3	ND	2.2	ND
Silver	2.2	ND	2.7	ND
Sodium	960	47	990	46
Thallium	2.2	ND	2.4	ND
Vanadium	200	ND	240	14
Zinc	900	ND	830	29
Total Organic Carbon	120,000	N/A	170,000	N/A
ND - Non detect				

TABLE 5 - TOTAL METAL AND TOTAL ORGANIC CARBON SAMPLE SUMMARY

Total Metals	SC-SED-16	SC-SW-16	SC-SED-17	SC-SW-17
	mg/Kg	ug/L	mg/Kg	ug/L
Aluminum	13,000	2500	2,800	ND
Antimony	170	59	18	ND
Arsenic	24	ND	4.7	ND
Barium	13	550	130	83
Beryllium	0.76	ND	ND	ND
Cadmium	5.5	ND	2.2	ND
Calcium	14,000	63	260,000	34
Chromium	3800	810	1900	270
Cobalt	15	ND	8	ND
Copper	320	56	54	ND
Iron	62,000	29,000	24,000	1,100
Lead	30,000	12,000	4,400	380
Magnesium	3,400	14	7,200	17
Manganese	420	540	1900	57
Nickel	76	20	29	10
Mercury	0.023	0.2	0.21	ND
Potassium	840	8.9	240	8
Selenium	2.3	ND	ND	ND
Silver	2.2	ND	ND	ND
Sodium	850	44	1,500	69
Strontium	3.2	ND	ND	ND
Vanadium	210	56	76	ND
Zinc	1600	400	1200	59
Total Organic Carbon	120,000	N/A	28,000	N/A
ND - Non detect				

TABLE 5 - TOTAL METAL AND TOTAL ORGANIC CARBON SAMPLE SUMMARY

Total Metals	SC-SED-18	SC-SW-18	SC-SED-31	SC-SW-31
	mg/Kg	ug/L	mg/Kg	ug/L
Aluminum	2,500	ND	20,000	ND
Antimony	12	ND	65	ND
Arsenic	3.2	ND	3.4	ND
Barium	380	70	130	71
Beryllium	ND	ND	ND	ND
Cadmium	1.3	ND	0.78	ND
Calcium	280,000	35	240,000	35
Chromium	1,600	260	13,000	270
Cobalt	4.4	ND	64	ND
Copper	34	ND	15	ND
Iron	12,000	430	35,000	450
Lead	3600	140	150	150
Magnesium	7,400	18	38,000	18
Manganese	1500	45	620	46
Nickel	14	10	380	10
Mercury	0.21	ND	0.21	ND
Potassium	180	8.3	ND	8.3
Selenium	ND	ND	ND	ND
Silver	ND	ND	ND	ND
Sodium	1300	70	650	71
Thallium	ND	ND	ND	ND
Vanadium	41	ND	260	ND
Zinc	870	13	120	18
Total Organic Carbon	16,000	N/A	11,000	N/A
ND - Non detect				
SC-SED-31 is a duplicate of SC-SED-18 and SC-SW-31 is a duplicate of SC-SW-18				

TABLE 5 - TOTAL METAL AND TOTAL ORGANIC CARBON SAMPLE SUMMARY

Total Metals	SC-SED-19	SC-SW-19	SC-SED-20	SC-SW-20
	mg/Kg	ug/L	mg/Kg	ug/L
Aluminum	19,000	ND	8,300	690
Antimony	55	ND	18	ND
Arsenic	24	ND	3	ND
Barium	63	70	200	91
Beryllium	0.68	ND	ND	ND
Cadmium	3.3	ND	0.79	ND
Calcium	7,500	46	260,000	110
Chromium	5100	250	3700	720
Cobalt	22	ND	3.3	ND
Copper	210	ND	25	ND
Iron	77,000	1,400	30,000	4,600
Lead	13,000	310	330	ND
Magnesium	4,600	22	9,500	26
Manganese	220	120	930	280
Nickel	100	11	11	9.4
Mercury	0.028	ND	0.067	ND
Potassium	780	9	270	12
Selenium	1.1	ND	ND	ND
Silver	1.4	ND	ND	ND
Sodium	350	69	2300	97
Thallium	ND	ND	ND	ND
Vanadium	320	ND	86	21
Zinc	1000	13	100	ND
Total Organic Carbon	100,000	N/A	14,000	N/A
ND - Non detect				

TABLE 5 - TOTAL METAL AND TOTAL ORGANIC CARBON SAMPLE SUMMARY

Total Metals	SC-SED-21	SC-SW-21	RB-01	
	mg/Kg	ug/L	ug/L	
Aluminum	11,000	1,900	ND	
Antimony	68	16	ND	
Arsenic	25	16	ND	
Barium	320	200	ND	
Beryllium	0.55	ND	ND	
Cadmium	2.6	ND	ND	
Calcium	6,800	92	ND	
Chromium	2100	350	ND	
Cobalt	8.9	ND	ND	
Copper	320	48	ND	
Iron	42,000	31,000	ND	
Lead	3,500	490	ND	
Magnesium	4,800	15	ND	
Manganese	120	380	ND	
Nickel	37	9.9	ND	
Mercury	0.47	0.16	ND	
Potassium	820	9.5	ND	
Selenium	2.4	ND	ND	
Silver	0.9	ND	ND	
Sodium	570	28	ND	
Thallium	ND	ND	ND	
Vanadium	140	30	ND	
Zinc	570	150	ND	
Total Organic Carbon	160,000	N/A	ND	
ND - Non detect				

## **A.7 Transformer Area Data**

**1990-1993 Remedial Investigation  
Excerpt from RI Report**



Free phase product was observed in sample SB-2 (B) from the sand just above the clay, and in the groundwater sample from MW-15L. Based on these results, it appears that the soils (and free phase product) in the vicinity of Building 2 are a continuing source of contamination to the groundwater. The source of the contamination appears to be from the handling of materials shipped to and from the site.

### **5.3.2 Transformer Area Sediment**

One sediment sample (S-3) was collected from the surface of a concrete pad in a former transformer area (Figure 5-1) and analyzed for PCBs. Elevated PCB Aroclor-1260 (5,160 mg/kg) were detected in the sediment. This sample was analyzed only for PCBs, therefore it is not known whether interference effects produced by the presence of high concentrations of chlorobenzenes affect the reliability of the PCBs results (see Subsection 5.1).

## **5.4 MIGRATION PATHWAYS**

The RI addressed two potential migration pathways for chemical releases from the site: surface water drainage and groundwater.

### **5.4.1 Surface Drainage**

#### **5.4.1.1 Description of Site Drainage**

Surface water drains from the site along two paths which lead respectively to outfalls to the Hackensack River at the northeastern and southeastern corners of the property. The northeast outfall receives drainage from the northwestern corner of the property. Runoff collects in a depression which drains through a culvert into a buried storm drain which runs along the entire northern border of the SCCC property. The storm drain also receives runoff from the Belleville Turnpike. The outfall is totally submerged at high

## 1997-1999 Supplemental Remedial Investigation

TABLE 3-1

**SOIL ANALYTICAL RESULTS FOR PCB's  
STANDARD CHLORINE CHEMICAL COMPANY**

CONSTITUENT: (Units in mg/kg)	New Jersey Non-Residential Soil Cleanup Criteria	New Jersey Residential Soil Cleanup Criteria	SITE: DESCRIPTION: DATE: DEPTH (ft): ANALYTICAL METHOD:	TA-CC01 CONCRETE CHIP 10/9/98 0" - 1"		TA-SS01 SURFACE SOIL 10/9/98 0" - 6"		TA-SS02 SURFACE SOIL 10/9/98 0" - 6"		TA-SS03 SURFACE SOIL 10/9/98 0" - 6"	
				8081	8082	8081	8082	8081	8082	8081	8082
PCB-1016				< 340	< 28	< 0.034	< 0.055	< 0.034	< 0.055	< 0.036	< 0.055
PCB-1221				< 340	< 6	< 0.034	< 0.011	< 0.034	< 0.011	< 0.036	< 0.011
PCB-1232				< 340	< 28	< 0.034	< 0.055	< 0.034	< 0.055	< 0.036	< 0.055
PCB-1242				< 340	< 28	< 0.034	< 0.055	< 0.034	< 0.055	< 0.036	< 0.055
PCB-1248				< 340	< 31	< 0.034	< 0.061	< 0.034	< 0.061	< 0.036	< 0.061
PCB-1254				< 340	< 22	< 0.034	< 0.044	< 0.034	< 0.044	< 0.036	< 0.044
PCB-1260				6800	9300	0.15	0.12	0.16	0.29	0.022 J	< 0.076
PCB's (Total)	2	0.49		[6800]	[9300]	0.15	0.12	0.16	0.29	0.022 J	ND

[ ] - Indicates sample concentration greater than New Jersey Non-Residential Soil Cleanup Criteria.

J - Estimated concentration less than the method detection limit.

## **B.1 Soil and Sediment Data**

## **1989-2001 Remedial Investigation**

**TABLE 113-01**  
**SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION**  
**TOTAL Cr, Cr(VI), pH, PERCENT SOLIDS AND ORP**  
**SITE 113 - DIAMOND SITE**

Sample ID	Date Collected	Laboratory	Units (A)	Total Cr	Cr(VI)	Cr(VI) Dilution Factor	pH (s.u.)	Percent Solids	ORP (mV) (Eh)
113-B-101-00-0.5-030992-053	09/03/92	Accutest	mg/Kg	145	9.8	1	7.4	82	NR
113-B-101-02-04-030992-053	09/03/92	Accutest	mg/Kg	36,100	4,680	50	13	61	165
113-B-101-12-13-030992-053	09/03/92	Accutest	mg/Kg	32,500	3,610	50	13	60	NR
113-B-101-14-16-090992-056	09/09/92	Accutest	mg/Kg	88.6	12.8	1	11	84	58
113-B-101-14-16-D-090992-056	09/09/92	Accutest	mg/Kg	115	3.9	1	11	84	NR
113-B-102-00-0.5-270892-050	08/27/92	Accutest	mg/Kg	78.4	45	10	7.7	85	NR
113-B-102-02-04-270892-050	08/27/92	Accutest	mg/Kg	20,800	7,067	200	10.0	60	155
113-B-102-12-14-270892-050	08/27/92	Accutest	mg/Kg	5,390	4,560	200	8.6	59	177
113-B-102-12-14-D-270892-050	08/27/92	Accutest	mg/Kg	16,200	4,130	200	9.6	57	NR
113-B-102-18-20-040992-054	09/04/92	Accutest	mg/Kg	30.1	2.5	1	8.4	75	147
113-B-102-18-20-D-040992-054	09/04/92	Accutest	mg/Kg	47.7	2.1	1	8.5	79	NR
113-B-103-00-0.5-030992-053	09/03/92	Accutest	mg/Kg	3,830	186	20	8.6	81	NR
113-B-103-02-04-030992-053	09/03/92	Accutest	mg/Kg	5,390	369	20	10	79	269
113-B-103-02-04-D-030992-053	09/03/92	Accutest	mg/Kg	5,200	189	20	9.8	81	NR
113-B-103-08-10-030992-053	09/03/92	Accutest	mg/Kg	18,700	3,260	50	12	53	NR
113-B-103-12-14-110992-056	09/11/92	Accutest	mg/Kg	33.9	8.6	1	9.2	82	128
113-B-104-00-0.5-230992-065	09/23/92	Accutest	mg/Kg	17,300	4,590	200	12	69	NR
113-B-104-02-04-230992-065	09/23/92	Accutest	mg/Kg	29,200	5,330	200	12	62	124
113-B-104-02-04-D-230992-065	09/23/92	Accutest	mg/Kg	27,300	23.7	1	12	64	NR
113-B-104-10-12-230992-065	09/23/92	Accutest	mg/Kg	30,000	17,100	500	12	60	110
113-B-104-14-16-240992-069	09/24/92	Accutest	mg/Kg	66.1	1.8	1	10	80	46
113-B-104-14-16-D-240992-069	09/24/92	Accutest	mg/Kg	182	1.4	1	10	82	NR
113-B-105-00-0.5-290992-072	09/29/92	Accutest	mg/Kg	NR	2,380	100	12	69	NR
113-B-105-00-0.5-290992-072	09/29/92	Enseco-RMA	mg/Kg	17,400	NR	NR	NR	72	NR
113-B-105-02-04-290992-072	09/29/92	Accutest	mg/Kg	NR	352	20	12	72	205
113-B-105-02-04-290992-072	09/29/92	Enseco-RMA	mg/Kg	2,880	NR	NR	NR	70	NR
113-B-105-06-08-290992-072	09/29/92	Accutest	mg/Kg	NR	16,900	500	13	58	139
113-B-105-06-08-290992-072	09/29/92	Enseco-RMA	mg/Kg	37,200	NR	NR	NR	61	NR
113-B-105-14-15-300992-073	09/30/92	Accutest	mg/Kg	54.1	4	1	7.9	80	NR
113-B-105-14-15-D-300992-073	09/30/92	Accutest	mg/Kg	53	3.1	1	8.0	82	NR
113-B-106-00-0.5-121092-082	10/12/92	Accutest	mg/Kg	2,500	296	10	12	80	NR
113-B-106-02-04-121092-082	10/12/92	Accutest	mg/Kg	8,960	2,340	100	12	62	25
113-B-106-08-09-121092-082	10/12/92	Accutest	mg/Kg	5,840	8,300	200	13	52	NR

**TABLE 113-01**  
**SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION**  
**TOTAL Cr, Cr(VI), pH, PERCENT SOLIDS AND ORP**  
**SITE 113 - DIAMOND SITE**

Sample ID	Date Collected	Laboratory	Units (A)	Total Cr	Cr(VI)	Cr(VI) Dilution Factor	pH (s.u.)	Percent Solids	ORP (mV) (B)
113-B-106-11-13-141092-083	10/14/92	Accutest	mg/Kg	NR	1.3	1	8.5	85	NR
113-B-106-11-13-141092-083	10/14/92	Enseco-RMA	mg/Kg	23.8	NR	NR	NR	86	NR
113-B-107-00-0.5-121092-082	10/12/92	Accutest	mg/Kg	6,470	86.4	2	8.9	88	NR
113-B-107-02-04-121092-082	10/12/92	Accutest	mg/Kg	1,720	33.9	1	9.4	77	100
113-B-107-02-04-D-121092-082	10/12/92	Accutest	mg/Kg	1,390	24.8	1	9.4	79	NR
113-B-107-04-06-121092-082	10/12/92	Accutest	mg/Kg	590	0.81	1	9.3	73	NR
113-B-107-12-14-141092-083	10/14/92	Accutest	mg/Kg	NR	0.41	1	7.4	83	NR
113-B-107-12-14-141092-083	10/14/92	Enseco-RMA	mg/Kg	7.2	NR	NR	NR	87	NR
113-B-107-12-14-D-141092-083	10/14/92	Accutest	mg/Kg	NR	0.86	1	7.5	81	NR
113-B-107-12-14-D-141092-083	10/14/92	Enseco-RMA	mg/Kg	7.9	NR	NR	NR	88	NR
113-B-108-00-0.5-160992-060	09/16/92	Accutest	mg/Kg	631	1.1	1	8.5	81	NR
113-B-108-02-04-160992-060	09/16/92	Accutest	mg/Kg	3,790	6.7	1	9.7	67	216
113-B-108-02-04-D-160992-060	09/16/92	Accutest	mg/Kg	2,050	2.3	1	9.5	63	NR
113-B-108-04-06-160992-060	09/16/92	Accutest	mg/Kg	1,970	9.2	1	9.8	75	NR
113-B-108-10-12-170992-061	09/17/92	Accutest	mg/Kg	27.7	3.6	1	9.1	81	115
113-B-108-10-12-D-170992-061	09/17/92	Accutest	mg/Kg	23.9	1.7	1	9.6	82	NR
113-B-109-01-1.5-160992-060	09/16/92	Accutest	mg/Kg	954	41.2	1	9.2	85	NR
113-B-109-02-04-160992-060	09/16/92	Accutest	mg/Kg	365	55.9	1	11	72	241
113-B-109-06-08-160992-060	09/16/92	Accutest	mg/Kg	613	42.7	1	11	78	156
113-B-109-11-13-180992-061	09/18/92	Accutest	mg/Kg	70.4	3.7	1	11	80	-100
113-B-110-00-0.5-140992-058	09/14/92	Accutest	mg/Kg	3,820	34.8	1	8.8	85	NR
113-B-110-04-06-140992-058	09/14/92	Accutest	mg/Kg	45,300	16,400	500	13	51	178
113-B-110-08-10-140992-058	09/14/92	Accutest	mg/Kg	31,900	14,900	200	13	43	16
113-B-111-00-0.5-150992-059	09/15/92	Accutest	mg/Kg	888	3.3	1	7.7	80	NR
113-B-111-02-04-150992-059	09/15/92	Accutest	mg/Kg	10,100	312	50	9.2	78	91
113-B-111-06-08-150992-059	09/15/92	Accutest	mg/Kg	7,860	4,400	200	13	65	-352
113-B-112-00-0.5-220992-064	09/22/92	Accutest	mg/Kg	2,830	76.8	5	9.1	88	NR
113-B-112-00-0.5-D-220992-064	09/22/92	Enseco-RMA	mg/Kg	2,400	NR	NR	NR	88	NR
113-B-112-04-06-220992-064	09/22/92	Accutest	mg/Kg	2,300	91.8	5	12	88	NR

**TABLE 113-01**  
**SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION**  
**TOTAL Cr, Cr(VI), pH, PERCENT SOLIDS AND ORP**  
**SITE 113 - DIAMOND SITE**

Sample ID	Date Collected	Laboratory	Units (A)	Total Cr	Cr(VI)	Cr(VI) Dilution Factor	pH (s.u.)	Percent Solids	ORP (mV) (Eh)
113-B-112-08-10-220992-064	09/22/92	Accutest	mg/Kg	2,450	0.55	U 1	11	62	NR
113-B-113-0.0-0.5-231192-096	11/23/92	Accutest	mg/Kg	NR	1,880	100	10	55	NR
113-B-113-0.0-0.5-231192-096	11/23/92	Enseco-RMA	mg/Kg	27,200	NR	NR	NR	57	NR
113-B-113-2.0-4.0-231192-096	11/23/92	Accutest	mg/Kg	NR	7,690	200	12	58	NR
113-B-113-2.0-4.0-231192-096	11/23/92	Enseco-RMA	mg/Kg	26,400	NR	NR	NR	61	NR
113-B-113-14.0-16.0-231192-096	11/23/92	Accutest	mg/Kg	NR	8,460	200	12	61	NR
113-B-113-14.0-16.0-231192-096	11/23/92	Enseco-RMA	mg/Kg	26,300	NR	NR	NR	61	NR
113-B-114-00-0.5-100293-114	02/10/93	Lancaster	mg/Kg	325	5	1	7.1	76	NR
113-B-114-00-0.5-D-100293-114	02/10/93	Lancaster	mg/Kg	417	5	U 1	7.2	76	NR
113-B-114-02-04-100293-114	02/10/93	Lancaster	mg/Kg	20,000	7,400	100	12	62	NR
113-B-114-12-14-100293-114	02/10/93	Lancaster	mg/Kg	20,900	6,090	100	12	62	NR
113-B-115-00-0.5-250892-050	08/25/92	Accutest	mg/Kg	67.8	3.1	1	6.3	82	NR
113-B-115-02-04-250892-050	08/25/92	Accutest	mg/Kg	8,970	6.8	1	13	75	252
113-B-115-12-14-250892-050	08/25/92	Accutest	mg/Kg	44,300	413	10	11	39	NR
113-B-116-00-0.5-010992-051	09/01/92	Accutest	mg/Kg	1,430	17.7	1	7.7	83	NR
113-B-116-02-04-010992-051	09/01/92	Accutest	mg/Kg	36.6	1.9	1	10	90	375
113-B-116-02-04-D-010992-051	09/01/92	Accutest	mg/Kg	40	2.7	1	10	90	NR
113-B-116-08-10-010992-052	09/01/92	Accutest	mg/Kg	15,300	26.2	1	9.8	59	-211
113-B-116-08-10-D-010992-052	09/01/92	Accutest	mg/Kg	18,200	16.7	1	9.8	56	NR
113-B-117-00-0.5-241192-096	11/24/92	Accutest	mg/Kg	NR	9.7	1	7.4	79	NR
113-B-117-00-0.5-241192-096	11/24/92	Enseco-RMA	mg/Kg	403	NR	NR	NR	79	NR
113-B-117-02-04-241192-096	11/24/92	Accutest	mg/Kg	NR	170	5	9.8	64	NR
113-B-117-02-04-241192-096	11/24/92	Enseco-RMA	mg/Kg	8,450	NR	NR	NR	62	NR
113-B-117-12-13-241192-096	11/24/92	Accutest	mg/Kg	NR	8,260	200	12	55	NR
113-B-117-12-13-241192-096	11/24/92	Enseco-RMA	mg/Kg	23,500	NR	NR	NR	60	NR
113-B-118-0.0-0.5-231192-096	11/23/92	Accutest	mg/Kg	NR	4,790	200	12	62	NR
113-B-118-0.0-0.5-231192-096	11/23/92	Enseco-RMA	mg/Kg	26,700	NR	NR	NR	62	NR
113-B-118D-0.0-0.5-231192-096	11/23/92	Enseco-RMA	mg/Kg	30,200	NR	NR	NR	61	NR
113-B-118-2.0-4.0-231192-096	11/23/92	Accutest	mg/Kg	NR	7,360	200	12	60	NR
113-B-118-2.0-4.0-231192-096	11/23/92	Enseco-RMA	mg/Kg	36,900	NR	NR	NR	63	NR
113-B-118D-2.0-4.0-231192-096	11/23/92	Accutest	mg/Kg	NR	6,270	200	12	60	NR
113-B-118-8.0-10.0-231192-096	11/23/92	Accutest	mg/Kg	NR	6580	200	12	62	NR
113-B-118-8.0-10.0-231192-096	11/23/92	Enseco-RMA	mg/Kg	21,500	NR	NR	NR	65	NR



**TABLE 113-01**  
**SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION**  
**TOTAL Cr, Cr(VI), pH, PERCENT SOLIDS AND ORP**  
**SITE 113 - DIAMOND SITE**

Sample ID	Date Collected	Laboratory	Units (A)	Total Cr	Cr(VI)	Cr(VI) Dilution Factor	pH (s.u.)	Percent Solids	ORP (mV) (Eh)
113-B-119-00-0.5-010992-051	09/01/92	Accutest	mg/Kg	78.8	4.8	1	6.9	83	NR
113-B-119-02-04-010992-051	09/01/92	Accutest	mg/Kg	40,200	1.5	1	8.2	56	79
113-B-119-12-14-010992-052	09/01/92	Accutest	mg/Kg	6,560	33.7	1	11	72	-141
113-B-120-00-0.5-100592-077	05/10/92	Accutest	mg/Kg	NR	12.4	2	5.4	79	NR
113-B-120-00-0.5-100592-077	05/10/92	Enseco-RMA	mg/Kg	90.9	NR	NR	NR	87	NR
113-B-120-02-04-100592-077	05/10/92	Accutest	mg/Kg	NR	2	2	6.6	82	241
113-B-120-02-04-100592-077	05/10/92	Enseco-RMA	mg/Kg	3,870	NR	NR	NR	80	NR
113-B-120-06-08-100592-077	05/10/92	Accutest	mg/Kg	NR	1,220	100	12	50	178
113-B-120-06-08-100592-077	05/10/92	Enseco-RMA	mg/Kg	13,500	NR	NR	NR	52	NR
113-B-121-00-0.5-290992-072	09/29/92	Accutest	mg/Kg	NR	3,310	100	12	71	NR
113-B-121-00-0.5-290992-072	09/29/92	Enseco-RMA	mg/Kg	8,540	NR	NR	NR	74	NR
113-B-121-00-0.5-D-290992-072	09/29/92	Enseco-RMA	mg/Kg	10,100	NR	NR	NR	NR	NR
113-B-121-02-04-290992-072	09/29/92	Accutest	mg/Kg	NR	19,100	500	13	56	107
113-B-121-02-04-290992-072	09/29/92	Enseco-RMA	mg/Kg	36,600	NR	NR	NR	60	NR
113-B-121-02-04-D-290992-072	09/29/92	Accutest	mg/Kg	NR	23,800	500	13	57	NR
113-B-121-08-10-290992-072	09/29/92	Accutest	mg/Kg	NR	12,400	200	13	59	95
113-B-121-08-10-290992-072	09/29/92	Enseco-RMA	mg/Kg	24,900	NR	NR	NR	68	NR
113-B-122-00-0.5-140992-058	09/14/92	Accutest	mg/Kg	483	23	1	8.7	93	NR
113-B-122-02-04-140992-058	09/14/92	Accutest	mg/Kg	33,100	12,700	200	13	62	129
113-B-122-02-04-D-140992-058	09/14/92	Accutest	mg/Kg	35,800	13,000	200	13	64	NR
113-B-122-11-13-140992-058	09/14/92	Accutest	mg/Kg	25,400	4,960	200	13	57	95
113-B-123-00-0.5-100992-057	09/10/92	Accutest	mg/Kg	11,900	77.7	10	8.1	86	NR
113-B-123-00-0.5-150992-059	09/15/92	Accutest	mg/Kg	3,970	30.6	1	8.7	88	NR
113-B-123-02-04-150992-059	09/15/92	Accutest	mg/Kg	9,950	1,190	200	11	60	208
113-B-123-02-04-D-150992-059	09/15/92	Accutest	mg/Kg	11,300	1,630	200	11	67	NR
113-B-123-08-10-150992-059	09/15/92	Accutest	mg/Kg	29,800	8,210	200	13	57	-2
113-B-124-00-0.5-100992-057	09/10/92	Accutest	mg/Kg	2,710	24.6	1	9.6	78	NR
113-B-124-02-04-150992-058	09/15/92	Accutest	mg/Kg	9,230	1.3	1	8.9	71	140
113-B-124-08-10-150992-059	09/15/92	Accutest	mg/Kg	1,800	3.6	1	9.5	60	-68
113-B-125-02-2.5-100992-057	09/10/92	Accutest	mg/Kg	32,200	4,970	200	13	68	NR
113-B-125-04-06-100992-057	09/10/92	Accutest	mg/Kg	24,800	7,980	200	13	63	NR
113-B-125-06-08-100992-057	09/10/92	Accutest	mg/Kg	23,000	13,500	200	13	53	149
113-B-126-00-0.5-150992-058	09/15/92	Accutest	mg/Kg	1,510	44.3	1	9.0	79	NR

**TABLE 113-01**  
**SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION**  
**TOTAL Cr, Cr(VI), pH, PERCENT SOLIDS AND ORP**  
**SITE 113 - DIAMOND SITE**

Sample ID	Date Collected	Laboratory	Units (A)	Total Cr	Cr(VI)	Cr(VI) Dilution Factor	pH (s.u.)	Percent Solids	ORP (mV) (Lh)
113-B-126-02-04-150992-059	09/15/92	Accutest	mg/Kg	54,000	1,620	200	7.3	70	313
113-B-126-06-08-150992-059	09/15/92	Accutest	mg/Kg	6,150	262	50	9.3	62	NR
113-B-127-00-0.5-100592-077	05/10/92	Accutest	mg/Kg	NR	4,880	100	12	74	NR
113-B-127-00-0.5-100592-077	05/10/92	Enseco-RMA	mg/Kg	13,800	NR	NR	NR	76	NR
113-B-127-00-0.5-D-100592-077	05/10/92	Enseco-RMA	mg/Kg	NR	NR	NR	NR	73	NR
113-B-127-00-0.5-D-100592-077	05/10/92	Enseco-RMA	mg/Kg	16,800	NR	NR	NR	73	NR
113-B-127-02-04-100592-077	05/10/92	Accutest	mg/Kg	NR	1,340	100	12	76	132
113-B-127-02-04-100592-077	05/10/92	Enseco-RMA	mg/Kg	3,810	NR	NR	NR	77	NR
113-B-127-02-04-D-100592-077	05/10/92	Accutest	mg/Kg	NR	773	100	12	75	NR
113-B-127-12-14-100592-077	05/10/92	Accutest	mg/Kg	NR	11,700	200	13	58	NR
113-B-127-12-14-100592-077	05/10/92	Enseco-RMA	mg/Kg	28,400	NR	NR	NR	62	NR
113-B-128-00-0.5-150992-059	09/15/92	Accutest	mg/Kg	1,480	107	5	9.4	88	NR
113-B-128-05-5.5-221092-086	10/22/92	Accutest	mg/Kg	NR	1,800	100	12	79	240
113-B-128-05-5.5-221092-086	10/22/92	Enseco-RMA	mg/Kg	1,720	NR	NR	NR	81	NR
113-B-128-05-5.5-D-221092-086	10/22/92	Accutest	mg/Kg	NR	1,890	100	12	80	NR
113-B-128-05-5.5-D-221092-086	10/22/92	Enseco-RMA	mg/Kg	1,090	NR	NR	NR	87	NR
113-B-128A-00-0.5-191192-095	11/19/92	Accutest	mg/Kg	NR	1.9	1	7.9	95	NR
113-B-128A-00-0.5-191192-095	11/19/92	Enseco-RMA	mg/Kg	33.4	NR	NR	NR	95	NR
113-B-128A-00-0.5-D-191192-095	11/19/92	Enseco-RMA	mg/Kg	35.8	NR	NR	NR	94	NR
113-B-128A-02-04-191192-095	11/19/92	Accutest	mg/Kg	NR	11,400	200	11	43	195
113-B-128A-02-04-191192-095	11/19/92	Enseco-RMA	mg/Kg	14,700	NR	NR	NR	43	NR
113-B-128A-02-04-D-191192-095	11/19/92	Accutest	mg/Kg	NR	15,600	200	12	42	NR
113-B-128A-06-08-191192-095	11/19/92	Accutest	mg/Kg	NR	15,600	200	12	48	56
113-B-128A-06-08-191192-095	11/19/92	Enseco-RMA	mg/Kg	20,600	NR	NR	NR	56	NR
113-B-128B-00-0.5-191192-095	11/19/92	Accutest	mg/Kg	NR	137	50	8.9	84	NR
113-B-128B-00-0.5-191192-095	11/19/92	Enseco-RMA	mg/Kg	1,030	NR	NR	NR	86	NR
113-B-128B-02-04-191192-095	11/19/92	Accutest	mg/Kg	NR	314	100	10	84	NR
113-B-128B-02-04-191192-095	11/19/92	Enseco-RMA	mg/Kg	1,520	NR	NR	NR	84	NR
113-B-128B-08-10-191192-095	11/19/92	Accutest	mg/Kg	NR	1,510	100	8.8	52	NR
113-B-128B-08-10-191192-095	11/19/92	Enseco-RMA	mg/Kg	20,200	NR	NR	NR	62	NR
113-B-129-00-0.5-220992-064	09/22/92	Accutest	mg/Kg	3,160	408	20	9.3	85	NR
113-B-129-02-04-220992-064	09/22/92	Accutest	mg/Kg	2,430	86.8	5	10	70	NR
113-B-129-04-06-220992-064	09/22/92	Enseco-RMA	mg/Kg	1,080	NR	NR	NR	78	NR

**TABLE 113-01**  
**SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION**  
**TOTAL Cr, Cr(VI), pH, PERCENT SOLIDS AND ORP**  
**SITE 113 - DIAMOND SITE**

Sample ID	Date Collected	Laboratory	Units (A)	Total Cr	Cr(VI)	Cr(VI) Dilution Factor	pH (s.u.)	Percent Solids	ORP (mV) (Eh)
113-B-129-06-08-220992-064	09/22/92	Accutest	mg/Kg	2,920	44.1	1	10	66	NR
113-B-130-00-0.5-230992-065	09/23/92	Accutest	mg/Kg	7,630	173	25	9.2	85	NR
113-B-130-02-04-230992-065	09/23/92	Accutest	mg/Kg	821	283	25	11	73	294
113-B-130-04-06-230992-065	09/23/92	Accutest	mg/Kg	2,750	276	25	11	71	251
113-B-130-08-10-230992-065	09/23/92	Accutest	mg/Kg	9,330	451	25	8.1	12	NR
113-B-131-00-0.5-280992-070	09/28/92	Accutest	mg/Kg	7,430	5,200	200	12	78	NR
113-B-131-02-04-280992-070	09/28/92	Accutest	mg/Kg	3,700	69	5	9.2	75	243
113-B-131-02-04-D-280992-070	09/28/92	Accutest	mg/Kg	NR	46.5	1	10	77	NR
113-B-131-06-08-280992-070	09/28/92	Accutest	mg/Kg	4,260	31.4	1	9.2	73	262
113-B-132-00-0.5-280992-070	09/28/92	Accutest	mg/Kg	1,590	19.8	5	9.9	86	NR
113-B-132-02-04-280992-070	09/28/92	Accutest	mg/Kg	2,270	82.1	10	11	70	130
113-B-132-06-08-280992-070	09/28/92	Accutest	mg/Kg	3,530	907	20	12	60	NR
113-B-133-00-0.5-220992-064	09/22/92	Accutest	mg/Kg	4,020	312	20	11	83	NR
113-B-133-04-06-220992-064	09/22/92	Accutest	mg/Kg	11,500	1,780	50	12	61	85
113-B-133-04-06-13-220992-064	09/22/92	Accutest	mg/Kg	11,100	1,310	50	12	63	NR
113-B-133-08-10-220992-064	09/22/92	Accutest	mg/Kg	27,000	11,200	200	12	60	62
113-B-134-00-0.5-100992-057	09/10/92	Accutest	mg/Kg	4,310	422	100	9.8	83	NR
113-B-134-02-04-100992-057	09/10/92	Accutest	mg/Kg	11,500	2,960	200	13	62	123
113-B-134-08-10-100992-057	09/10/92	Accutest	mg/Kg	19,200	4,490	200	13	60	132
113-B-134-08-10-D-100992-057	09/10/92	Accutest	mg/Kg	22,000	3,580	200	13	59	NR
113-B-135-00-0.5-280992-070	09/28/92	Accutest	mg/Kg	8,370	2,170	50	12	78	NR
113-B-135-00-0.5-D-280992-070	09/28/92	Inseco-RMA	mg/Kg	7,700	NR	NR	NR	78	NR
113-B-135-02-04-280992-070	09/28/92	Accutest	mg/Kg	4,230	9.5	1	10	72	NR
113-B-135-06-08-280992-070	09/28/92	Accutest	mg/Kg	12,700	24.5	1	11	76	NR
113-SS-201-170992-062	09/17/92	Accutest	mg/Kg	1,510	15.8	1	7.7	73	NR
113-SS-201-D-170992-062	09/17/92	Accutest	mg/Kg	991	30	1	7.7	74	NR
113-SS-202-150992-059	09/15/92	Accutest	mg/Kg	449	21.3	1	7.6	80	NR
113-SS-203-150992-059	09/15/92	Accutest	mg/Kg	1,140	24.7	1	7.4	81	NR
113-SS-204-150992-059	09/15/92	Accutest	mg/Kg	1,510	34.6	1	10	79	NR
113-SS-205-150992-059	09/15/92	Accutest	mg/Kg	111	4.6	1	7.3	82	NR
113-SS-206-080992-055	09/08/92	Accutest	mg/Kg	515	19.1	1	8.2	84	NR
113-SS-207-080992-055	09/08/92	Accutest	mg/Kg	611	8	1	7.9	81	368
113-SS-208-080992-055	09/08/92	Accutest	mg/Kg	75.1	0.41 U	1	7.7	82	397

**TABLE 113-01**  
**SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION**  
**TOTAL Cr, Cr(VI), pH, PERCENT SOLIDS AND ORP**  
**SITE 113 - DIAMOND SITE**

Sample ID	Date Collected	Laboratory	Units (A)	Total Cr	Cr(VI)	Cr(VI) Dilution Factor	pH (s.u.)	Percent Solids	ORP (mV) (lb)
113-SS-209-080992-055	09/08/92	Accutest	mg/Kg	159	9.6	1	5.0	88	485
113-SS-210-010992-051	09/01/92	Accutest	mg/Kg	287	11.1	1	8.3	90	NR
113-SS-211-010992-051	09/01/92	Accutest	mg/Kg	59.2	2.6	1	6.2	89	NR
113-SS-212-030992-053	09/03/92	Accutest	mg/Kg	158	25	1	7.2	83	NR
113-SS-213-030992-053	09/03/92	Accutest	mg/Kg	102	8.5	1	7.5	86	NR
113-SS-214-080992-055	09/08/92	Accutest	mg/Kg	100	4.9	1	7.1	86	466
113-SS-215-080992-055	09/08/92	Accutest	mg/Kg	266	1.8	1	7.2	83	511
113-SS-215-D-080992-055	09/08/92	Accutest	mg/Kg	201	1.6	1	7.2	83	NR
113-SS-216-090992-055	09/09/92	Accutest	mg/Kg	101	14.2	1	7.0	89	NR
113-SS-217-090992-055	09/09/92	Accutest	mg/Kg	755	28.3	1	8.4	89	NR
113-SS-218-100992-055	09/10/92	Accutest	mg/Kg	249	37.1	10	7.2	76	NR
113-SS-219-100992-055	09/10/92	Accutest	mg/Kg	572	14	1	8.3	79	NR
113-SS-220-170992-062	09/17/92	Accutest	mg/Kg	216	23	1	3.6	86	NR
113-SS-221-090992-055	09/09/92	Accutest	mg/Kg	337	19.8	1	8.4	86	NR
113-SS-222-100992-055	09/10/92	Accutest	mg/Kg	167	7.8	1	6.9	79	NR
113-SS-223-170992-062	09/17/92	Accutest	mg/Kg	59.4	6.3	1	6.3	88	NR
113-SS-224-170992-062	09/17/92	Accutest	mg/Kg	141	4.1	1	7.3	85	NR
113-SS-225-300992-071	09/30/92	Accutest	mg/Kg	NR	91.1	5	8.4	73	NR
113-SS-225-300992-071	09/30/92	Enseco-RMA	mg/Kg	1,260	NR	NR	NR	76	NR
113-SS-226-300992-071	09/30/92	Accutest	mg/Kg	NR	13	1	6.2	77	NR
113-SS-226-300992-071	09/30/92	Enseco-RMA	mg/Kg	144	NR	NR	NR	78	NR
113-SS-227-300992-071	09/30/92	Accutest	mg/Kg	NR	5.8	1	6.1	83	NR
113-SS-227-300992-071	09/30/92	Enseco-RMA	mg/Kg	64.3	NR	NR	NR	84	NR
113-SS-228-210992-063	09/21/92	Accutest	mg/Kg	2,720	80	5	7.3	80	NR
113-SS-228-D-210992-063	09/21/92	Accutest	mg/Kg	1,280	30.0	1	7.4	78	NR
113-SS-229-300992-071	09/30/92	Accutest	mg/Kg	NR	31.2	1	10	90	NR
113-SS-229-300992-071	09/30/92	Enseco-RMA	mg/Kg	1,140	NR	NR	NR	93	NR
113-SS-230-300992-071	09/30/92	Accutest	mg/Kg	NR	16.8	1	7.0	79	NR
113-SS-230-300992-071	09/30/92	Enseco-RMA	mg/Kg	304	NR	NR	NR	78	NR
113-SS-231-210992-063	09/21/92	Accutest	mg/Kg	12,400	116	5	8.4	80	NR
113-SS-232-210992-063	09/21/92	Accutest	mg/Kg	3,390	29	1	7.7	85	NR
113-SS-233-210992-063	09/21/92	Accutest	mg/Kg	5,470	52.4	5	7.7	83	NR
113-SS-234-300992-071	09/30/92	Accutest	mg/Kg	NR	101	5	8.2	73	NR

**TABLE 113-01**  
**SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION**  
**TOTAL Cr, Cr(VI), pH, PERCENT SOLIDS AND ORP**  
**SITE 113 - DIAMOND SITE**

Sample ID	Date Collected	Laboratory	Units (A)	Total Cr	Cr(VI)	Cr(VI) Dilution Factor	pH (s.u.)	Percent Solids	ORP (mV) (Eh)
113-SS-234-300992-071	09/30/92	Inseco-RMA	mg/Kg	1,030	NR	NR	NR	73	NR
113-SS-235-220992-063	09/22/92	Accutest	mg/Kg	8,240	684	50	11	79	NR
113-SS-236-220992-063	09/22/92	Accutest	mg/Kg	3,650	90.8	5	8.7	85	NR
113-SS-237-210992-063	09/21/92	Accutest	mg/Kg	4,540	1,060	20	11	80	NR
113-SS-238-220992-063	09/22/92	Accutest	mg/Kg	6,150	694	20	10	80	NR
113-SS-239-220992-063	09/22/92	Accutest	mg/Kg	1,810	40.6	1	8.7	86	NR
113-SS-240-280992-071	09/28/92	Accutest	mg/Kg	NR	96.1	20	8.7	76	NR
113-SS-240-280992-071	09/28/92	Enseco-RMA	mg/Kg	4,140	NR	NR	NR	79	NR
113-SS-241-280992-071	09/28/92	Accutest	mg/Kg	NR	262	20	10	78	NR
113-SS-241-280992-071	09/28/92	Enseco-RMA	mg/Kg	2,850	NR	NR	NR	79	NR
113-SS-242-230992-063	09/23/92	Accutest	mg/Kg	757	20.1	1	8.1	84	NR
113-SS-243-230992-063	09/23/92	Accutest	mg/Kg	11,300	2,820	100	12	69	NR
113-SS-244-280992-071	09/28/92	Accutest	mg/Kg	NR	542	20	11	66	NR
113-SS-244-280992-071	09/28/92	Enseco-RMA	mg/Kg	4,580	NR	NR	NR	80	NR
113-SS-244-D-280992-071	09/28/92	Accutest	mg/Kg	NR	1,000	20	10	78	NR
113-SS-244-D-280992-071	09/28/92	Enseco-RMA	mg/Kg	4,140	NR	NR	NR	80	NR
113-SS-245-300992-071	09/30/92	Accutest	mg/Kg	NR	777	20	10	75	NR
113-SS-245-300992-071	09/30/92	Enseco-RMA	mg/Kg	4,750	NR	NR	NR	78	NR
113-SS-246-290992-071	09/29/92	Accutest	mg/Kg	NR	0.7	1	8.5	79	NR
113-SS-246-290992-071	09/29/92	Enseco-RMA	mg/Kg	2,710	NR	NR	NR	79	NR
113-SS-247-290992-071	09/29/92	Accutest	mg/Kg	NR	1,550	50	12	73	NR
113-SS-247-290992-071	09/29/92	Enseco-RMA	mg/Kg	3,940	NR	NR	NR	75	NR
113-SS-248-280992-071	09/28/92	Accutest	mg/Kg	NR	78.2	20	8.7	87	NR
113-SS-248-280992-071	09/28/92	Enseco-RMA	mg/Kg	1,240	NR	NR	NR	86	NR
113-SS-249-290992-071	09/29/92	Accutest	mg/Kg	NR	88.2	10	9.1	82	NR
113-SS-249-290992-071	09/29/92	Enseco-RMA	mg/Kg	2,070	NR	NR	NR	82	NR
113-SS-250-290992-071	09/29/92	Accutest	mg/Kg	NR	168	5	11	80	NR
113-SS-250-290992-071	09/29/92	Enseco-RMA	mg/Kg	3,560	NR	NR	NR	82	NR
113-SS-251-280992-071	09/28/92	Accutest	mg/Kg	NR	571	20	10	82	NR
113-SS-251-280992-071	09/28/92	Enseco-RMA	mg/Kg	4,670	NR	NR	NR	80	NR
113-SF-122A-151092-084	10/15/92	Accutest	mg/Kg	NR	0.56	U 1	7.2	60	NR
113-SF-122A-151092-084	10/15/92	Enseco-RMA	mg/Kg	908	NR	NR	NR	52	NR
113-SF-122A-D-151092-084	10/15/92	Accutest	mg/Kg	NR	3.9	1	7.2	55	NR

**TABLE 113-01**  
**SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION**  
**TOTAL Cr, Cr(VI), pH, PERCENT SOLIDS AND ORP**  
**SITE 113 - DIAMOND SITE**

Sample ID	Date Collected	Laboratory	Units (A)	Total Cr	Cr(VI)	Cr(VI) Dilution Factor	pH (s.u.)	Percent Solids	ORP (mV) (B)	
113-SE-122A-D-151092-084	10/15/92	Enseco-RMA	mg/Kg	1120	NR	NR	NR	51	NR	
113-SE-123A-081092-079	10/08/92	Accutest	mg/Kg	NR	1	1	7.6	51	NR	
113-SE-123A-081092-079	10/08/92	Enseco-RMA	mg/Kg	675	NR	NR	NR	53	NR	
113-SE-123A-D-081092-079	10/08/92	Accutest	mg/Kg	NR	0.64	U	1	7.7	53	NR
113-SE-123A-D-081092-079	10/08/92	Enseco-RMA	mg/Kg	751	NR	NR	NR	52	NR	
113-SE-123B-081092-079	10/08/92	Accutest	mg/Kg	NR	0.61	U	1	8.7	55	NR
113-SE-123B-081092-079	10/08/92	Enseco-RMA	mg/Kg	3,660	NR	NR	NR	71	NR	
113-SE-123C-081092-080	10/08/92	Accutest	mg/Kg	NR	0.69	1	8.6	69	NR	
113-SE-123C-081092-080	10/08/92	Enseco-RMA	mg/Kg	1,050	NR	NR	NR	76	NR	
113-SE-123C-D-081092-080	10/08/92	Accutest	mg/Kg	NR	8.6	1	8.4	70	NR	
113-SE-123C-D-081092-080	10/08/92	Enseco-RMA	mg/Kg	222	NR	NR	NR	74	NR	
113-SE-124A-011092-075	10/01/92	Accutest	mg/Kg	NR	0.97	U	1	7.7	35	NR
113-SE-124A-011092-075	10/01/92	Enseco-RMA	mg/Kg	531	NR	NR	NR	38	NR	
113-SE-124A-D-011092-075	10/01/92	Accutest	mg/Kg	NR	2.8	1	7.7	35	NR	
113-SE-124A-D-011092-075	10/01/92	Enseco-RMA	mg/Kg	547	NR	NR	NR	40	NR	
113-SE-124B-011092-075	10/01/92	Accutest	mg/Kg	NR	7	1	7.8	74	NR	
113-SE-124B-011092-075	10/01/92	Enseco-RMA	mg/Kg	39.3	NR	NR	NR	77	NR	
113-SE-124C-011092-076	10/01/92	Accutest	mg/Kg	NR	0.49	U	1	8.2	69	NR
113-SE-124C-011092-076	10/01/92	Enseco-RMA	mg/Kg	54.8	NR	NR	NR	73	NR	
113-SE-124C-D-011092-076	10/01/92	Accutest	mg/Kg	NR	3.2	1	8.1	70	NR	
113-SE-124C-D-011092-076	10/01/92	Enseco-RMA	mg/Kg	29.3	NR	NR	NR	70	NR	
113-SE-125A-240992-066	09/24/92	Accutest	mg/Kg	3,000	19	1	8.3	65	NR	
113-SE-125B-240992-066	09/24/92	Accutest	mg/Kg	520	0.91	U	1	7.3	37	NR
113-SE-125C-240992-067	09/24/92	Accutest	mg/Kg	429	6.3	1	8.3	62	NR	
113-SE-126A-230992-066	09/23/92	Accutest	mg/Kg	312	6.5	1	7.5	38	NR	
113-SE-126A-D-230992-066	09/23/92	Accutest	mg/Kg	347	6	1	7.6	39	NR	
113-SE-126B-230992-066	09/23/92	Accutest	mg/Kg	282	4.7	1	7.1	43	NR	
113-SE-126C-230992-067	09/23/92	Accutest	mg/Kg	3,000	2.5	1	8.4	58	NR	
113-SE-126C-D-230992-067	09/23/92	Accutest	mg/Kg	2,000	16.1	1	8.6	55	NR	

Notes:

(A) - Unless otherwise specified

**TABLE 113-01**  
**SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION**  
**TOTAL Cr, Cr(VI), pH, PERCENT SOLIDS AND ORP**  
**SITE 113 - DIAMOND SITE**

Sample ID	Date Collected	Laboratory	Units (A)	Total Cr	Cr(VI)	Cr(VI) Dilution Factor	pH (s.u.)	Percent Solids	ORP (mV) (Eh)
A,B,C' - Designates relatively increasing distance of sediment samples from shoreline.									
B - Boring									
SE - Sediment									
SS - Surface Soil									
D - Field Duplicate									
NR - Not Requested									
U - The material was analyzed for this parameter, but was not detected at or above the associated numerical value.									
Eh - Field ORP measurement has been converted to Eh based on the reference electrode used.									
mV - Millivolts									
(s.u.) - Standard Units									

**TABLE 113-02**  
**SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION**  
**METALS OF INTEREST**  
**SITE 113 - DIAMOND SITE**

Sample ID	Date Collected	Laboratory	Units	Antimony	Arsenic	Beryllium	Cadmium	Nickel	Vanadium
113-B-101-00-0.5-030992-053	09/03/92	Accutest	mg/Kg	0.15	4.0	0.85	0.49	U 20.7	78.3
113-B-101-02-04-030992-053	09/03/92	Accutest	mg/Kg	0.19	2.0	0.16	U 0.66	523	241
113-B-101-12-13-030992-053	09/03/92	Accutest	mg/Kg	0.17	U 2.3	0.17	U 0.67	480	240
113-B-101-14-16-090992-056	09/09/92	Accutest	mg/Kg	0.34	1.1	0.60	0.48	U 12.3	42.0
113-B-101-14-16-D-090992-056	09/09/92	Accutest	mg/Kg	0.29	0.94	0.60	0.48	U 15.0	33.9
113-B-102-00-0.5-270892-050	08/27/92	Accutest	mg/Kg	0.27	6.3	0.71	0.47	U 16.6	43.5
113-B-102-02-04-270892-050	08/27/92	Accutest	mg/Kg	1.6	4.6	0.17	0.67	U 362	518
113-B-102-12-14-270892-050	08/27/92	Accutest	mg/Kg	0.17	U 3.7	0.68	U 0.68	153	161
113-B-102-12-14-D-270892-050	08/27/92	Accutest	mg/Kg	0.20	2.0	0.15	U 0.58	444	363
113-B-102-18-20-040992-054	09/04/92	Accutest	mg/Kg	0.13	U 1.1	0.13	0.53	U 5.6	18.0
113-B-102-18-20-D-040992-054	09/04/92	Accutest	mg/Kg	0.30	1.3	0.25	0.51	U 7.1	19.9
113-B-103-00-0.5-030992-053	09/03/92	Accutest	mg/Kg	0.93	5.8	0.62	0.49	U 235	699
113-B-103-02-04-030992-053	09/03/92	Accutest	mg/Kg	0.94	3.6	0.63	0.51	U 229	576
113-B-103-02-04-D-030992-053	09/03/92	Accutest	mg/Kg	1.3	5.7	0.62	0.49	U 288	740
113-B-103-08-10-030992-053	09/03/92	Accutest	mg/Kg	1.6	10.8	0.19	U 0.75	338	353
113-B-103-12-14-110992-056	09/11/92	Accutest	mg/Kg	0.12	U 1.9	0.61	0.49	U 12.0	29.6
113-B-104-00-0.5-230992-065	09/23/92	Enseco-RMA	mg/Kg	5.0	U 4.2	0.28	U 1.4	449	465
113-B-104-02-04-230992-065	09/23/92	Enseco-RMA	mg/Kg	16.4	1.2	U 0.30	U 1.5	575	283
113-B-104-02-04-D-230992-065	09/23/92	Enseco-RMA	mg/Kg	5.6	U 2.4	0.31	U 1.6	566	311
113-B-104-10-12-230992-065	09/23/92	Enseco-RMA	mg/Kg	10.0	6.6	U 0.33	U 1.6	601	264
113-B-104-14-16-240992-069	09/24/92	Enseco-RMA	mg/Kg	4.5	U 1.4	0.59	1.2	U 6.9	27.8
113-B-104-14-16-D-240992-069	09/24/92	Enseco-RMA	mg/Kg	4.4	U 1.6	0.56	1.2	U 6.0	27.1
113-B-105-00-0.5-290992-072	02/29/92	Enseco-RMA	mg/Kg	44.3	4.3	0.28	U 2.7	466	537
113-B-105-02-04-290992-072	02/29/92	Enseco-RMA	mg/Kg	5.6	3.4	0.44	1.4	U 96.2	196
113-B-105-06-08-290992-072	02/29/92	Enseco-RMA	mg/Kg	92.2	7.8	0.65	U 3.3	731	266
113-B-105-14-15-300992-073	09/30/92	Enseco-RMA	mg/Kg	4.5	U 1.1	0.35	1.3	U 10.3	19.4
113-B-105-14-15-D-300992-073	09/30/92	Enseco-RMA	mg/Kg	4.6	U 1.1	0.68	1.3	U 8.7	16.8
113-B-106-00-0.5-121092-082	10/12/92	Enseco-RMA	mg/Kg	4.3	U 8.4	0.24	U 1.2	307	717
113-B-106-02-04-121092-082	10/12/92	Enseco-RMA	mg/Kg	5.8	U 7.2	0.32	U 1.6	464	354
113-B-106-08-09-121092-082	10/12/92	Enseco-RMA	mg/Kg	6.9	U 16.2	0.38	U 1.9	219	96.2
113-B-106-11-13-141092-083	10/14/92	Enseco-RMA	mg/Kg	4.3	U 1.0	0.62	1.2	U 13.0	25.0
113-B-107-00-0.5-121092-082	10/12/92	Enseco-RMA	mg/Kg	10.3	7.3	0.37	1.2	U 97.0	295



**TABLE 113-02**  
**SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION**  
**METALS OF INTEREST**  
**SITE 113 - DIAMOND SITE**

Sample ID	Date Collected	Laboratory	Units	Antimony	Arsenic	Beryllium	Cadmium	Nickel	Vanadium			
113-B-107-02-04-121092-082	10/12/92	Enseco-RMA	mg/Kg	4.4	U	17.1	1.2	U	73.0	75.0		
113-B-107-02-04-D-121092-082	10/12/92	Enseco-RMA	mg/Kg	4.4	U	8.3	3.4	U	47.4	119		
113-B-107-04-06-121092-082	10/12/92	Enseco-RMA	mg/Kg	11.4		41.2	0.36	U	18.3	30.9		
113-B-107-12-14-141092-083	10/14/92	Enseco-RMA	mg/Kg	4.4	U	1.0	0.44	U	6.4	9.6		
113-B-107-12-14-D-141092-083	10/14/92	Enseco-RMA	mg/Kg	4.3	U	0.99	0.45	U	7.0	10.1		
113-B-108-00-0.5-160992-060	09/16/92	Accutest	mg/Kg	0.94		7.0	0.62		44.7	25.6		
113-B-108-02-04-160992-060	09/16/92	Accutest	mg/Kg	3.6		16.5	0.45	U	9.4	16.0		
113-B-108-02-04-D-160992-060	09/16/92	Accutest	mg/Kg	1.1		14.8	0.48	U	11.6	17.0		
113-B-108-04-06-160992-060	09/16/92	Accutest	mg/Kg	1.1		9.2	0.40	U	13.3	19.1		
113-B-108-10-12-170992-061	09/17/92	Accutest	mg/Kg	0.25	U	1.0	0.25	U	6.9	14.8		
113-B-108-10-12-D-170992-061	09/17/92	Accutest	mg/Kg	0.24	U	0.89	0.37	U	6.3	16.6		
113-B-109-01-1.5-160992-060	09/16/92	Accutest	mg/Kg	0.60		4.5	0.47		31.3	36.5		
113-B-109-02-04-160992-060	09/16/92	Accutest	mg/Kg	0.42		17.1	1.4		8.6	9.3		
113-B-109-06-08-160992-060	09/16/92	Accutest	mg/Kg	0.37		9.0	0.51	U	38.6	12.2		
113-B-109-11-13-180992-061	09/18/92	Accutest	mg/Kg	0.25	U	2.0	0.62	U	11.4	29.5		
113-B-110-00-0.5-140992-058	09/14/92	Accutest	mg/Kg	1.3		6.2	0.35	U	116	529		
113-B-110-04-06-140992-058	09/14/92	Accutest	mg/Kg	3.7		13.7	0.39	U	718	296		
113-B-110-08-10-140992-058	09/14/92	Accutest	mg/Kg	7.7		34.5	0.31	U	383	197		
113-B-111-00-0.5-150992-059	09/15/92	Accutest	mg/Kg	3.0		13.8	0.62		18.8	75.4		
113-B-111-02-04-150992-059	09/15/92	Accutest	mg/Kg	2.1		22.9	1.2	U	69.1	165		
113-B-111-06-08-150992-059	09/15/92	Accutest	mg/Kg	0.65		8.8	0.46	U	108	66.2		
113-B-112-00-0.5-220992-064	09/22/92	Enseco-RMA	mg/Kg	4.1	U	2.5	0.23	U	1.1	U	148	405
113-B-112-00-0.5-D-220992-064	09/22/92	Enseco-RMA	mg/Kg	4.1	U	2.1	0.23	U	1.1	U	188	519
113-B-112-04-06-220992-064	09/22/92	Enseco-RMA	mg/Kg	4.4	U	6.6	0.31		6.2		52.2	23.2
113-B-112-08-10-220992-064	09/22/92	Enseco-RMA	mg/Kg	5.5	U	8.3	0.31	U	1.5	U	31.0	25.4
113-B-113-0.0-0.5-231192-096	11/23/92	Enseco-RMA	mg/Kg	29.5		5.1	0.33	U	1.6	U	622	329
113-B-113-14.0-16.0-231192-096	11/23/92	Enseco-RMA	mg/Kg	21.3		2.9	0.33	U	1.6	U	436	276
113-B-113-2.0-4.0-231192-096	11/23/92	Enseco-RMA	mg/Kg	27.3		2.3	0.33	U	1.7	U	550	293
113-B-114-00-0.5-100293-114	02/10/93	Enseco-RMA	mg/Kg	4.3	U	6.5	0.97		0.69	U	28.1	57.2
113-B-114-00-0.5-D-100293-114	02/10/93	Enseco-RMA	mg/Kg	4.3	U	6.1	1.1		0.69	U	38.5	86.1
113-B-114-02-04-100293-114	02/10/93	Enseco-RMA	mg/Kg	88.4		15.3	1.5		0.82	U	620	422
113-B-114-12-14-100293-114	02/10/93	Enseco-RMA	mg/Kg	91.9		15.3	1.0		0.82	U	776	245

**TABLE 113-02**  
**SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION**  
**METALS OF INTEREST**  
**SITE 113 - DIAMOND SITE**

Sample ID	Date Collected	Laboratory	Units	Antimony	Arsenic	Beryllium	Cadmium	Nickel	Vanadium
113-B-115-00-0.5-250892-050	08/25/92	Accutest	mg/Kg	0.17	5.0	0.85	0.73	17.2	48.8
113-B-115-02-04-250892-050	08/25/92	Accutest	mg/Kg	1.9	2.0	0.40	0.53	283	867
113-B-115-12-14-250892-050	08/25/92	Accutest	mg/Kg	4.3	4.8	0.68	0.68	59.3	1390
113-B-116-00-0.5-010992-051	09/01/92	Accutest	mg/Kg	0.40	3.6	0.84	0.48	58.0	76.0
113-B-116-02-04-010992-051	09/01/92	Accutest	mg/Kg	0.13	1.3	0.56	0.44	16.4	17.6
113-B-116-02-04-D-010992-051	09/01/92	Accutest	mg/Kg	0.15	1.5	0.67	0.44	17.9	21.9
113-B-116-08-10-010992-052	09/01/92	Accutest	mg/Kg	1.3	11.8	1.6	0.52	145	339
113-B-116-08-10-D-010992-052	09/01/92	Accutest	mg/Kg	1.6	16.7	1.2	0.71	172	370
113-B-117-00-0.5-241192-096	11/24/92	Accutest	mg/Kg	4.7	3.8	1.1	1.3	54.0	73.8
113-B-117-02-04-241192-096	11/24/92	Enseco-RMA	mg/Kg	19.4	3.9	0.33	U	155	927
113-B-117-12-13-241192-096	11/24/92	Enseco-RMA	mg/Kg	16.2	6.3	0.36	U	527	441
113-B-118-0.0-0.5-231192-096	11/23/92	Enseco-RMA	mg/Kg	28.0	1.3	0.32	U	591	287
113-B-118-2-4-231192-096	11/23/92	Enseco-RMA	mg/Kg	31.1	0.64	0.32	U	600	294
113-B-118-8.0-10.0-231192-096	11/23/92	Enseco-RMA	mg/Kg	32.8	3.1	0.32	U	519	270
113-B-118D-0.0-0.5-231192-096	11/23/92	Enseco-RMA	mg/Kg	32.2	2.5	0.33	U	648	290
113-B-119-00-0.5-010992-051	09/01/92	Accutest	mg/Kg	4.3	23.7	1.1	1.3	41.8	123
113-B-119-02-04-010992-051	09/01/92	Accutest	mg/Kg	2.2	16.0	2.3	0.71	172	582
113-B-119-12-14-010992-052	09/01/92	Accutest	mg/Kg	0.14	5.2	0.69	0.56	71.5	94.7
113-B-120-00-0.5-100592-077	10/05/92	Enseco-RMA	mg/Kg	4.1	1.6	0.24	1.1	4.0	42.0
113-B-120-02-04-100592-077	10/05/92	Enseco-RMA	mg/Kg	6.4	3.3	0.25	U	183	561
113-B-120-06-08-100592-077	10/05/92	Enseco-RMA	mg/Kg	14.2	6.0	0.39	U	540	522
113-B-121-00-0.5-290992-072	09/29/92	Enseco-RMA	mg/Kg	23.4	1.7	0.27	U	625	2260
113-B-121-00-0.5-13-290992-072	09/29/92	Enseco-RMA	mg/Kg	28.0	2.2	0.27	U	612	1950
113-B-121-02-04-290992-072	09/29/92	Enseco-RMA	mg/Kg	106	2.4	0.66	U	711	443
113-B-121-08-10-290992-072	09/29/92	Enseco-RMA	mg/Kg	61.4	2.9	0.29	U	545	241
113-B-122-00-0.5-140992-058	09/14/92	Accutest	mg/Kg	0.22	2.6	0.43	0.43	34.8	73.3
113-B-122-02-04-140992-058	09/14/92	Accutest	mg/Kg	1.2	2.5	0.16	U	605	218
113-B-122-02-04-D-140992-058	09/14/92	Accutest	mg/Kg	1.5	2.8	0.16	U	545	198
113-B-122-11-13-140992-058	09/14/92	Accutest	mg/Kg	0.46	2.8	0.18	U	518	200
113-B-123-00-0.5-100992-057	09/10/92	Accutest	mg/Kg	1.1	3.4	0.47	0.47	86.7	230
113-B-123-00-0.5-150992-059	09/15/92	Accutest	mg/Kg	44.9	4.5	0.45	0.45	91.0	273
113-B-123-02-04-150992-059	09/15/92	Accutest	mg/Kg	0.89	10.8	0.66	0.66	231	116

**TABLE 113-02**  
**SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION**  
**METALS OF INTEREST**  
**SITE 113 - DIAMOND SITE**

Sample ID	Date Collected	Laboratory	Units	Antimony	Arsenic	Beryllium	Cadmium	Nickel	Vanadium
113-B-123-02-04-D-150992-059	09/15/92	Accutest	mg/Kg	0.93	21.0	0.60	0.60	U 294	133
113-B-123-08-10-150992-059	09/15/92	Accutest	mg/Kg	1.3	3.0	0.18	U 0.71	U 584	214
113-B-124-00-0.5-100992-057	09/10/92	Accutest	mg/Kg	1.2	2.2	0.38	0.51	U 62.9	163
113-B-124-02-04-150992-058	09/15/92	Accutest	mg/Kg	0.28	U 3.5	0.42	0.56	U 146	261
113-B-124-08-10-150992-059	09/15/92	Accutest	mg/Kg	0.44	5.1	1.7	0.67	U 70.5	42.5
113-B-125-02-2.5-100992-057	09/10/92	Accutest	mg/Kg	1.2	7.4	0.29	0.59	U 581	412
113-B-125-04-06-100992-057	09/10/92	Accutest	mg/Kg	9.2	37.3	0.32	0.63	U 452	256
113-B-125-06-08-100992-057	09/10/92	Accutest	mg/Kg	12.6	36.1	0.19	U 0.75	U 409	208
113-B-126-00-0.5-150992-058	09/15/92	Accutest	mg/Kg	0.80	3.9	0.25	0.51	U 43.8	159
113-B-126-02-04-150992-059	09/15/92	Accutest	mg/Kg	0.83	8.1	0.57	0.57	U 159	102
113-B-126-06-08-150992-059	09/15/92	Accutest	mg/Kg	0.60	21.1	1.1	0.66	U 106	50.2
113-B-127-00-0.5-100592-077	10/05/92	Enseco-RMA	mg/Kg	18.1	9.5	0.26	U 1.3	U 411	541
113-B-127-00-0.5-10-100592-077	10/05/92	Enseco-RMA	mg/Kg	27.6	4.3	0.28	U 1.4	U 440	650
113-B-127-02-04-100592-077	10/05/92	Enseco-RMA	mg/Kg	5.5	3.6	0.26	U 1.3	U 296	633
113-B-127-12-14-100592-077	10/05/92	Enseco-RMA	mg/Kg	33.7	1.6	0.32	U 1.6	U 625	266
113-B-128-00-0.5-150992-059	09/15/92	Accutest	mg/Kg	0.86	4.2	0.57	0.68	47.4	144
113-B-128-05-5.5-221092-086	10/22/92	Enseco-RMA	mg/Kg	4.7	U 2.3	1.0	1.3	U 10.0	37.3
113-B-128-05-5.5-D-221092-086	10/22/92	Enseco-RMA	mg/Kg	4.3	U 5.8	1.0	1.2	U 11.8	40.0
113-B-128A-00-0.5-191192-095	11/19/92	Enseco-RMA	mg/Kg	3.8	U 0.42	U 0.70	1.1	U 14.8	38.1
113-B-128A-00-0.5-D-191192-095	11/19/92	Enseco-RMA	mg/Kg	3.8	U 0.42	U 0.79	1.1	U 14.8	25.6
113-B-128A-02-04-191192-095	11/19/92	Enseco-RMA	mg/Kg	21.5	44.1	1.6	2.4	U 587	299
113-B-128A-06-08-191192-095	11/19/92	Enseco-RMA	mg/Kg	25.2	41.7	0.95	1.9	U 398	213
113-B-128A-06-08-10-191192-095	11/19/92	Enseco-RMA	mg/Kg	NR	NR	NR	NR	NR	NR
113-B-128B-00-0.5-191192-095	11/19/92	Enseco-RMA	mg/Kg	4.2	U 8.3	0.88	1.2	U 102	275
113-B-128B-02-04-191192-095	11/19/92	Enseco-RMA	mg/Kg	7.1	2.7	0.80	1.6	32.6	106
113-B-128B-08-10-191192-095	11/19/92	Enseco-RMA	mg/Kg	11.3	3.5	1.0	1.4	U 14.1	156
113-B-129-00-0.5-220992-064	09/22/92	Enseco-RMA	mg/Kg	4.3	U 5.0	0.24	U 1.2	U 223	661
113-B-129-04-06-220992-064	09/22/92	Enseco-RMA	mg/Kg	4.6	U 3.8	0.27	1.3	U 66.5	138
113-B-129-06-08-220992-064	09/22/92	Enseco-RMA	mg/Kg	5.6	U 9.4	0.36	1.6	U 21.9	38.5
113-B-130-00-0.5-230992-065	09/23/92	Enseco-RMA	mg/Kg	10.6	6.1	0.39	1.2	U 69.5	231
113-B-130-02-04-230992-065	09/23/92	Enseco-RMA	mg/Kg	5.0	U 5.2	0.54	2.4	17.9	18.4
113-B-130-04-06-230992-065	09/23/92	Enseco-RMA	mg/Kg	5.1	U 88.9	0.52	1.4	U 21.9	25.7

**TABLE 113-02**  
**SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION**  
**METALS OF INTEREST**  
**SITE 113 - DIAMOND SITE**

Sample ID	Date Collected	Laboratory	Units	Antimony	Arsenic	Beryllium	Cadmium	Nickel	Vanadium
113-B-131-00-0.5-280992-070	09/28/92	Enseco-RMA	mg/Kg	6.2	1.4	0.50	1.3	U 512	1300
113-B-131-02-04-280992-070	09/28/92	Enseco-RMA	mg/Kg	4.7	14.4	0.99	1.3	U 83.5	249
113-B-131-06-08-280992-070	09/28/92	Enseco-RMA	mg/Kg	5.9	12.9	0.50	1.4	U 35.0	25.6
113-B-132-02-04-280992-070	09/28/92	Enseco-RMA	mg/Kg	11.9	30.7	0.84	1.5	U 193	109
113-B-132-06-08-280992-070	09/28/92	Enseco-RMA	mg/Kg	4.5	U 6.5	2.0	1.3	U 70.5	108
113-B-133-00-0.5-220992-064	09/22/92	Enseco-RMA	mg/Kg	4.4	U 4.3	0.28	1.8	250	729
113-B-133-04-06-220992-064	09/22/92	Enseco-RMA	mg/Kg	5.9	U 28.6	1.5	1.6	U 351	256
113-B-133-08-10-220992-064	09/22/92	Enseco-RMA	mg/Kg	5.7	U 30.1	1.7	1.6	U 305	203
113-B-134-00-0.5-100992-057	09/10/92	Accutest	mg/Kg	1.1	4.1	0.48	0.48	U 214	563
113-B-134-02-04-100992-057	09/10/92	Accutest	mg/Kg	0.61	3.0	0.32	0.65	U 310	261
113-B-134-08-10-100992-057	09/10/92	Accutest	mg/Kg	0.18	4.2	0.17	U 0.67	U 450	192
113-B-134-08-10-D-100992-057	09/10/92	Accutest	mg/Kg	0.25	2.9	0.17	U 0.68	U 451	198
113-B-135-00-0.5-280992-070	09/28/92	Enseco-RMA	mg/Kg	7.2	4.0	0.58	1.3	U 436	1140
113-B-135-00-0.5-D-280992-070	09/28/92	Enseco-RMA	mg/Kg	7.6	4.5	0.59	1.3	U 463	1240
113-B-135-02-04-280992-070	09/28/92	Enseco-RMA	mg/Kg	4.6	U 4.2	0.30	1.3	U 204	177
113-B-135-06-08-280992-070	09/28/92	Enseco-RMA	mg/Kg	11.7	22.5	0.46	1.6	U 238	328
113-SE-122A-151092-084	10/15/92	Enseco-RMA	mg/Kg	7.0	U 16.5	1.5	2.3	62.0	96.9
113-SE-122A-D-151092-084	10/15/92	Enseco-RMA	mg/Kg	7.1	U 14.5	1.5	2.0	U 65.1	88.7
113-SE-123A-081092-079	10/08/92	Enseco-RMA	mg/Kg	6.9	U 8.7	0.83	1.9	U 38.7	65.5
113-SE-123A-D-081092-079	10/08/92	Enseco-RMA	mg/Kg	12.7	8.8	0.91	2.1	46.3	73.6
113-SE-123B-081092-079	10/08/92	Enseco-RMA	mg/Kg	5.1	U 32.0	0.75	1.4	U 103	133
113-SE-123C-081092-080	10/08/92	Enseco-RMA	mg/Kg	5.0	U 9.0	0.86	1.4	U 68.4	90.6
113-SE-123C-D-081092-080	10/08/92	Enseco-RMA	mg/Kg	5.3	U 7.0	1.2	1.5	U 38.8	42.3
113-SE-124A-011092-075	09/11/92	Enseco-RMA	mg/Kg	9.5	U 12.0	1.7	2.7	52.5	71.2
113-SE-124A-D-011092-075	09/11/92	Enseco-RMA	mg/Kg	9.0	U 13.4	1.6	2.5	U 55.9	87.4
113-SE-124B-011092-075	09/11/92	Enseco-RMA	mg/Kg	4.7	U 6.1	1.1	1.3	U 27.3	27.7
113-SE-124C-011092-076	09/11/92	Enseco-RMA	mg/Kg	5.0	U 6.3	1.4	1.4	U 35.2	37.7
113-SE-124C-D-011092-076	09/11/92	Enseco-RMA	mg/Kg	5.0	U 7.2	1.4	1.4	U 33.7	34.1
113-SE-125A-240992-066	09/24/92	Enseco-RMA	mg/Kg	7.3	19.9	0.27	U 1.4	U 272	560
113-SE-125B-240992-066	09/24/92	Enseco-RMA	mg/Kg	7.9	U 98.0	1.0	3.4	54.3	47.9
113-SE-125C-240992-067	09/24/92	Enseco-RMA	mg/Kg	4.9	U 9.3	0.84	1.4	U 70.9	106
113-SE-126A-230992-066	09/23/92	Enseco-RMA	mg/Kg	8.8	U 14.1	0.77	2.4	U 41.1	43.3

**TABLE 113-02**  
**SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION**  
**METALS OF INTEREST**  
**SITE 113 - DIAMOND SITE**

Sample ID	Date Collected	Laboratory	Units	Antimony	Arsenic	Beryllium	Cadmium	Nickel	Vanadium
113-SE-126A-D-230992-066	09/23/92	Enseco-RMA	mg/Kg	8.8 U	13.0	0.90	3.0	45.4	47.1
113-SE-126B-230992-066	09/23/92	Enseco-RMA	mg/Kg	8.1 U	101	0.88	2.2 U	43.1	38.7
113-SE-126C-230992-067	09/23/92	Enseco-RMA	mg/Kg	8.0	19.2	1.3	3.1	115	194
113-SE-126C-D-230992-067	09/23/92	Enseco-RMA	mg/Kg	8.8	18.1	0.59	1.7 U	244	532
NJDEP Residential Guidelines			mg/Kg	14	20	2	39	250	370
NJDEP Non-Residential Guidelines			mg/Kg	340	20	2	100	2400	7100

**Notes:**

A,B,C - Designates relatively increasing distance of sediment samples from shoreline.

B - Boring

SE - Sediment

D - Field Duplicate

NR - Not Requested

U - The material was analyzed for this parameter, but was not detected at or above the associated numerical value.

<input type="checkbox"/>	-Concentration exceeds NJDEP Residential Guidelines
<input type="checkbox"/>	-Concentration exceeds NJDEP Non-Residential Guidelines

**TABLE 113 - 03**  
**SUMMARY OF SLUG TEST RESULTS**  
**SITE 113 - DIAMOND SITE**

Monitoring Wells	<u>Hydraulic Conductivity (Bouwer/Rice)</u>		
	Feet/minute (ft/m)	Feet/day	Centimeters/second
113-W-101 (Rising)	1.30E-04	1.87E-01	6.59E-05
113-W-101 (Falling)	2.38E-04	3.43E-01	1.21E-04
113-W-102 (Rising)	1.63E-03	2.35E+00	8.28E-04
113-W-102 (Falling)	1.92E-03	2.77E+00	9.78E-04
113-W-103 (Rising)	6.86E-04	9.88E-01	3.49E-04
113-W-103 (Falling)	7.96E-04	1.15E+00	4.05E-04
113-W-104 (Rising)	1.54E-03	2.22E+00	7.83E-04
113-W-104 (Falling)	1.07E-03	1.55E+00	5.45E-04
113-W-105 (Rising)	3.68E-03	5.30E+00	1.87E-03
113-W-105 (Falling)	3.54E-03	5.09E+00	1.80E-03
113-W-106 (Rising)	6.53E-04	9.40E-01	3.32E-04
113-W-106 (Falling)	5.67E-04	8.17E-01	2.88E-04
113-W-107 (Rising)	1.07E-03	1.54E+00	5.44E-04
113-W-107 (Falling)	1.13E-03	1.63E+00	5.77E-04
113-W-108 (Rising)	1.90E-03	2.74E+00	9.68E-04
113-W-108 (Falling)	2.14E-03	3.08E+00	1.09E-03
113-W-109 (Rising)	3.08E-03	4.43E+00	1.56E-03
113-W-109 (Falling)	2.64E-03	3.81E+00	1.34E-03
113-W-113 (Rising)	1.92E-03	2.76E+00	9.59E-04
113-W-113 (Falling)	5.82E-03	8.39E+00	2.91E-03
113-W-114 (Rising)	3.25E-03	4.68E+00	1.63E-03
113-W-114 (Falling)	3.11E-03	4.48E+00	1.56E-03
113-W-115 (Rising)	4.57E-03	6.59E+00	2.29E-03
113-W-115 (Falling)	5.75E-04	8.28E-01	2.87E-04
113-W-116 (Rising)	9.29E-03	1.34E+01	4.65E-03
113-W-116 (Falling)	1.29E-02	1.86E+01	6.46E-03
113-W-117 (Rising)	1.79E-03	2.58E+00	8.95E-04
113-W-117 (Falling)	1.28E-03	1.85E+00	6.42E-04
113-W-118 (Rising)	9.81E-04	1.41E+00	4.91E-04
113-W-118 (Falling)	7.62E-04	1.10E+00	3.81E-04
113-W-119 (Rising)	4.27E-03	6.16E+00	2.14E-03
113-W-119 (Falling)	7.80E-03	1.12E+01	3.90E-03
113-W-120 (Rising)	7.17E-03	1.03E+01	3.59E-03
113-W-121 (Rising)	3.68E-02	5.30E+01	1.84E-02
113-W-121 (Falling)	2.53E-02	3.64E+01	1.28E-02

**TABLE 113-07**  
**CHROMIUM DATABASE FOR STATISTICAL ANALYSIS OF SOIL SAMPLES**  
**SITE 113 - DIAMOND SITE**

Sample ID	Units (A)	Total Cr	Cr(VI)	Sample ID	Units (A)	Total Cr	Cr(VI)
113-B-101-00-0.5-030992-053	mg/Kg	145	9.8	113-B-127-02-04-100592-077	mg/Kg	NR	1,340
113-B-101-02-04-030992-053	mg/Kg	36,100	4,680	113-B-127-02-04-100592-077	mg/Kg	3,810	NR
113-B-101-12-13-030992-053	mg/Kg	32,500	3,610	113-B-127-12-14-100592-077	mg/Kg	NR	11,700
113-B-101-14-16-090992-056	mg/Kg	88.6	12.8	113-B-127-12-14-100592-077	mg/Kg	28,400	NR
113-B-102-00-0.5-270892-050	mg/Kg	78.4	45	113-B-128-00-0.5-150992-059	mg/Kg	1,480	107
113-B-102-02-04-270892-050	mg/Kg	20,800	7,067	113-B-128-05-5.5-221092-086	mg/Kg	NR	1,800
113-B-102-12-14-270892-050	mg/Kg	5,390	4,560	113-B-128-05-5.5-221092-086	mg/Kg	1,720	NR
113-B-102-18-20-040992-054	mg/Kg	30.1	2.5	113-B-128A-00-0.5-191192-095	mg/Kg	NR	1.9
113-B-103-00-0.5-030992-053	mg/Kg	3,830	186	113-B-128A-00-0.5-191192-095	mg/Kg	33.4	NR
113-B-103-02-04-030992-053	mg/Kg	5,390	369	113-B-128A-02-04-191192-095	mg/Kg	NR	11,400
113-B-103-08-10-030992-053	mg/Kg	18,700	3,260	113-B-128A-02-04-191192-095	mg/Kg	14,700	NR
113-B-103-12-14-110992-056	mg/Kg	33.9	8.6	113-B-128A-06-08-191192-095	mg/Kg	NR	15,600
113-B-104-00-0.5-230992-065	mg/Kg	17,300	4,590	113-B-128A-06-08-191192-095	mg/Kg	20,600	NR
113-B-104-02-04-230992-065	mg/Kg	29,200	5,330	113-B-128B-00-0.5-191192-095	mg/Kg	NR	137
113-B-104-10-12-230992-065	mg/Kg	30,000	17,100	113-B-128B-00-0.5-191192-095	mg/Kg	1,030	NR
113-B-104-14-16-240992-069	mg/Kg	66.1	1.8	113-B-128B-02-04-191192-095	mg/Kg	NR	314
113-B-105-00-0.5-290992-072	mg/Kg	NR	2,380	113-B-128B-02-04-191192-095	mg/Kg	1,520	NR
113-B-105-00-0.5-290992-072	mg/Kg	17,400	NR	113-B-128B-08-10-191192-095	mg/Kg	NR	1,510
113-B-105-02-04-290992-072	mg/Kg	NR	352	113-B-128B-08-10-191192-095	mg/Kg	20,200	NR
113-B-105-02-04-290992-072	mg/Kg	2,880	NR	113-B-129-00-0.5-220992-064	mg/Kg	3,160	408
113-B-105-06-08-290992-072	mg/Kg	NR	16,900	113-B-129-02-04-220992-064	mg/Kg	2,430	86.8
113-B-105-06-08-290992-072	mg/Kg	37,200	NR	113-B-129-04-06-220992-064	mg/Kg	1,080	NR
113-B-105-14-15-300992-073	mg/Kg	54.1	4	113-B-129-06-08-220992-064	mg/Kg	2,920	44.1
113-B-106-00-0.5-121092-082	mg/Kg	2,500	296	113-B-130-00-0.5-230992-065	mg/Kg	7,630	173
113-B-106-02-04-121092-082	mg/Kg	8,960	2,340	113-B-130-02-04-230992-065	mg/Kg	821	283
113-B-106-08-09-121092-082	mg/Kg	5,840	8,300	113-B-130-04-06-230992-065	mg/Kg	2,750	276
113-B-106-11-13-141092-083	mg/Kg	NR	1.3	113-B-130-08-10-230992-065	mg/Kg	9,330	451
113-B-106-11-13-141092-083	mg/Kg	23.8	NR	113-B-131-00-0.5-280992-070	mg/Kg	7,430	5,200
113-B-107-00-0.5-121092-082	mg/Kg	6,470	86.4	113-B-131-02-04-280992-070	mg/Kg	3,700	69
113-B-107-02-04-121092-082	mg/Kg	1,720	33.9	113-B-131-06-08-280992-070	mg/Kg	4,260	31.4
113-B-107-04-06-121092-082	mg/Kg	590	0.81	113-B-132-00-0.5-280992-070	mg/Kg	1,590	19.8
113-B-107-12-14-141092-083	mg/Kg	NR	0.41	113-B-132-02-04-280992-070	mg/Kg	2,270	82.1

**TABLE 113-07**  
**CHROMIUM DATABASE FOR STATISTICAL ANALYSIS OF SOIL SAMPLES**  
**SITE 113 - DIAMOND SITE**

Sample ID	Units (A)	Total Cr	Cr(VI)	Sample ID	Units (A)	Total Cr	Cr(VI)
113-B-107-12-14-141092-083	mg/Kg	7.2	NR	113-B-132-06-08-280992-070	mg/Kg	3,530	907
113-B-108-00-0.5-160992-060	mg/Kg	631	1.1	113-B-133-00-0.5-220992-064	mg/Kg	4,020	312
113-B-108-02-04-160992-060	mg/Kg	3,790	6.7	113-B-133-04-06-220992-064	mg/Kg	11,500	1,780
113-B-108-04-06-160992-060	mg/Kg	1,970	9.2	113-B-133-08-10-220992-064	mg/Kg	27,000	11,200
113-B-108-10-12-170992-061	mg/Kg	27.7	3.6	113-B-134-00-0.5-100992-057	mg/Kg	4,310	422
113-B-109-01-1.5-160992-060	mg/Kg	954	41.2	113-B-134-02-04-100992-057	mg/Kg	11,500	2,960
113-B-109-02-04-160992-060	mg/Kg	365	55.9	113-B-134-08-10-100992-057	mg/Kg	19,200	4,490
113-B-109-06-08-160992-060	mg/Kg	613	42.7	113-B-135-00-0.5-280992-070	mg/Kg	8,370	2,170
113-B-109-11-13-180992-061	mg/Kg	70.4	3.7	113-B-135-02-04-280992-070	mg/Kg	4,230	9.5
113-B-110-00-0.5-140992-058	mg/Kg	3,820	34.8	113-B-135-06-08-280992-070	mg/Kg	12,700	24.5
113-B-110-04-06-140992-058	mg/Kg	45,300	16,400	113-SS-201-170992-062	mg/Kg	1,510	15.8
113-B-110-08-10-140992-058	mg/Kg	31,900	14,900	113-SS-202-150992-059	mg/Kg	449	21.3
113-B-111-00-0.5-150992-059	mg/Kg	888	3.3	113-SS-203-150992-059	mg/Kg	1,140	24.7
113-B-111-02-04-150992-059	mg/Kg	10,100	312	113-SS-204-150992-059	mg/Kg	1,510	34.6
113-B-111-06-08-150992-059	mg/Kg	7,860	4,400	113-SS-205-150992-059	mg/Kg	111	4.6
113-B-112-00-0.5-220992-064	mg/Kg	2,830	76.8	113-SS-206-030992-053	mg/Kg	515	19.1
113-B-112-04-06-220992-064	mg/Kg	2,300	91.8	113-SS-207-080992-055	mg/Kg	611	8
113-B-112-08-10-220992-064	mg/Kg	2,450	0.55	113-SS-208-080992-055	mg/Kg	75.1	0.41
113-B-113-0.0-0.5-231192-096	mg/Kg	NR	1,880	113-SS-209-080992-055	mg/Kg	159	9.6
113-B-113-0.0-0.5-231192-096	mg/Kg	27,200	NR	113-SS-210-010992-051	mg/Kg	287	11.1
113-B-113-2.0-4.0-231192-096	mg/Kg	NR	7,690	113-SS-211-010992-051	mg/Kg	59.2	2.6
113-B-113-2.0-4.0-231192-096	mg/Kg	26,400	NR	113-SS-212-030992-053	mg/Kg	158	25
113-B-113-14.0-16.0-231192-096	mg/Kg	NR	8,460	113-SS-213-030992-053	mg/Kg	102	8.5
113-B-113-14.0-16.0-231192-096	mg/Kg	26,300	NR	113-SS-214-080992-055	mg/Kg	100	4.9
113-B-114-00-0.5-100293-114	mg/Kg	325	5	113-SS-215-080992-055	mg/Kg	266	1.8
113-B-114-02-04-100293-114	mg/Kg	20,000	7,400	113-SS-216-090992-055	mg/Kg	101	14.2
113-B-114-12-14-100293-114	mg/Kg	20,900	6,090	113-SS-217-090992-055	mg/Kg	755	28.3
113-B-115-00-0.5-250892-050	mg/Kg	67.8	3.1	113-SS-218-100992-055	mg/Kg	249	37.1
113-B-115-02-04-250892-050	mg/Kg	8,970	6.8	113-SS-219-100992-055	mg/Kg	572	14
113-B-115-12-14-250892-050	mg/Kg	44,300	413	113-SS-220-170992-062	mg/Kg	216	23
113-B-116-00-0.5-010992-051	mg/Kg	1,430	17.7	113-SS-221-090992-055	mg/Kg	337	19.8
113-B-116-02-04-010992-051	mg/Kg	36.6	1.9	113-SS-222-100992-055	mg/Kg	167	7.8
113-B-116-08-10-010992-052	mg/Kg	15,300	26.2	113-SS-223-170992-062	mg/Kg	59.4	6.3
113-B-117-00-0.5-241192-096	mg/Kg	NR	9.7	113-SS-224-170992-062	mg/Kg	141	4.1
113-B-117-00-0.5-241192-096	mg/Kg	403	NR	113-SS-225-300992-071	mg/Kg	NR	91.1



**TABLE 113-07**  
**CHROMIUM DATABASE FOR STATISTICAL ANALYSIS OF SOIL SAMPLES**  
**SITE 113 - DIAMOND SITE**

Sample ID	Units (A)	Total Cr	Cr(VI)	Sample ID	Units (A)	Total Cr	Cr(VI)
113-B-117-02-04-241192-096	mg/Kg	NR	170	113-SS-225-300992-071	mg/Kg	1,260	NR
113-B-117-02-04-241192-096	mg/Kg	8,450	NR	113-SS-226-300992-071	mg/Kg	NR	13
113-B-117-12-13-241192-096	mg/Kg	NR	8,260	113-SS-226-300992-071	mg/Kg	144	NR
113-B-117-12-13-241192-096	mg/Kg	23,500	NR	113-SS-227-300992-071	mg/Kg	NR	5.8
113-B-118-0.0-0.5-231192-096	mg/Kg	NR	4,790	113-SS-227-300992-071	mg/Kg	64.3	NR
113-B-118-0.0-0.5-231192-096	mg/Kg	26,700	NR	113-SS-228-210992-063	mg/Kg	2,720	80
113-B-118-0.0-0.5-231192-096	mg/Kg	NR	7,360	113-SS-229-300992-071	mg/Kg	NR	31.2
113-B-118-2.0-4.0-231192-096	mg/Kg	36,900	NR	113-SS-229-300992-071	mg/Kg	1,140	NR
113-B-118-8.0-10.0-231192-096	mg/Kg	NR	6580	113-SS-230-300992-071	mg/Kg	NR	16.8
113-B-118-8.0-10.0-231192-096	mg/Kg	21,500	NR	113-SS-230-300992-071	mg/Kg	304	NR
113-B-119-00-0.5-010992-051	mg/Kg	78.8	4.8	113-SS-231-210992-063	mg/Kg	12,400	116
113-B-119-02-04-010992-051	mg/Kg	40,200	1.5	113-SS-232-210992-063	mg/Kg	3,390	29
113-B-119-12-14-010992-052	mg/Kg	6,560	33.7	113-SS-233-210992-063	mg/Kg	5,470	52.4
113-B-120-00-0.5-100592-077	mg/Kg	NR	12.4	113-SS-234-300992-071	mg/Kg	NR	101
113-B-120-00-0.5-100592-077	mg/Kg	90.9	NR	113-SS-234-300992-071	mg/Kg	1,030	NR
113-B-120-02-04-100592-077	mg/Kg	NR	2	113-SS-235-220992-063	mg/Kg	8,240	684
113-B-120-02-04-100592-077	mg/Kg	3,870	NR	113-SS-236-220992-063	mg/Kg	3,650	90.8
113-B-120-06-08-100592-077	mg/Kg	NR	1,220	113-SS-237-210992-063	mg/Kg	4,540	1,060
113-B-120-06-08-100592-077	mg/Kg	13,500	NR	113-SS-238-220992-063	mg/Kg	6,150	694
113-B-121-00-0.5-290992-072	mg/Kg	NR	3,310	113-SS-239-220992-063	mg/Kg	1,810	40.6
113-B-121-00-0.5-290992-072	mg/Kg	8,540	NR	113-SS-240-280992-071	mg/Kg	NR	96.1
113-B-121-02-04-290992-072	mg/Kg	NR	19,100	113-SS-240-280992-071	mg/Kg	4,140	NR
113-B-121-02-04-290992-072	mg/Kg	36,600	NR	113-SS-241-280992-071	mg/Kg	NR	262
113-B-121-08-10-290992-072	mg/Kg	NR	12,400	113-SS-241-280992-071	mg/Kg	2,850	NR
113-B-121-08-10-290992-072	mg/Kg	24,900	NR	113-SS-242-230992-063	mg/Kg	757	20.1
113-B-122-00-0.5-140992-058	mg/Kg	483	23	113-SS-243-230992-063	mg/Kg	11,300	2,820
113-B-122-02-04-140992-058	mg/Kg	33,100	12,700	113-SS-244-280992-071	mg/Kg	NR	542
113-B-122-11-13-140992-058	mg/Kg	25,400	4,960	113-SS-244-280992-071	mg/Kg	4,580	NR
113-B-123-00-0.5-100992-057	mg/Kg	11,900	77.7	113-SS-245-300992-071	mg/Kg	NR	777
113-B-123-00-0.5-150992-059	mg/Kg	3,970	30.6	113-SS-245-300992-071	mg/Kg	4,750	NR
113-B-123-02-04-150992-059	mg/Kg	9,950	1,190	113-SS-246-290992-071	mg/Kg	NR	0.7
113-B-123-08-10-150992-059	mg/Kg	29,800	8,210	113-SS-246-290992-071	mg/Kg	2,710	NR
113-B-124-00-0.5-100992-057	mg/Kg	2,710	24.6	113-SS-247-290992-071	mg/Kg	NR	1,550
113-B-124-02-04-150992-058	mg/Kg	9,230	1.3	113-SS-247-290992-071	mg/Kg	3,940	NR
113-B-124-08-10-150992-059	mg/Kg	1,800	3.6	113-SS-248-280992-071	mg/Kg	NR	78.2

**TABLE 113-07**  
**CHROMIUM DATABASE FOR STATISTICAL ANALYSIS OF SOIL SAMPLES**  
**SITE 113 - DIAMOND SITE**

Sample ID	Units (A)	Total Cr	Cr(VI)	Sample ID	Units (A)	Total Cr	Cr(VI)
113-B-125-02-2.5-100992-057	mg/Kg	32,200	4,970	113-SS-248-280992-071	mg/Kg	1,240	NR
113-B-125-04-06-100992-057	mg/Kg	24,800	7,980	113-SS-249-290992-071	mg/Kg	NR	88.2
113-B-125-06-08-100992-057	mg/Kg	23,000	13,500	113-SS-249-290992-071	mg/Kg	2,070	NR
113-B-126-00-0.5-150992-058	mg/Kg	1,510	44.3	113-SS-250-290992-071	mg/Kg	NR	168
113-B-126-02-04-150992-059	mg/Kg	54,000	1,620	113-SS-250-290992-071	mg/Kg	3,560	NR
113-B-126-06-08-150992-059	mg/Kg	6,150	262	113-SS-251-280992-071	mg/Kg	NR	571
113-B-127-00-0.5-100592-077	mg/Kg	NR	4,880	113-SS-251-280992-071	mg/Kg	4,670	NR
113-B-127-00-0.5-100592-077	mg/Kg	13,800	NR				

**Notes:**

(A) - Unless otherwise specified

NR - Not Requested

B - Boring

SS - Surface Soil

U - The material was analyzed for this parameter, but was not detected at or above the associated numerical value.

## **B.2 Groundwater and Surface Water Data**

## 1989-2001 Remedial Investigation

**TABLE 113-04**  
**SUMMARY OF GROUNDWATER AND SURFACE WATER CHARACTERIZATION**  
**TOTAL Cr, Cr (VI), pH, ORP AND PERCENT SOLIDS**  
**SITE 113 - DIAMOND SITE**

Sample ID	Date Collected	Laboratory	Units (A)	Total Cr	Cr(VI)	Dilution Factor	pH (s.u.)	Percent Solids	ORP mV (Eh)	Cr(VI) by IC	Total Dissolved		Total Suspended Solids (mg/L)		
											Solids (mg/L)	Chlorides (mg/L)			
113-W-101-070693-162F	06/07/93	Lancaster	ug/L	14.3	10	U	1	NR	NR	173	NR	NR	NR	NR	
113-W-101-070693-162T	06/07/93	Lancaster	ug/L	616	10	U	1	6.4	NR	173	NR	NR	NR	NR	
113-W-101-040696-853F	06/04/96	Lancaster	ug/L	92.2	10	U	1	NR	NR	NR	NR	NR	NR	340	
113-W-101-040696-853T	06/04/96	Lancaster	ug/L	321	10	U	1	6.0	NR	144	NR	NR	NR	270	
113-W-102-100693-165F	06/10/93	Lancaster	ug/L	18,100	20	U	2	NR	NR	NR	NR	NR	NR	NR	
113-W-102-100693-165T	06/10/93	Lancaster	ug/L	21,300	20	U	2	7.3	NR	365	NR	NR	NR	NR	
113-W-102-230596-849F	05/23/96	Lancaster	ug/L	22,500	1,000	U	100	NR	NR	NR	10	U	24,700	860	9
113-W-102-230596-849T	05/23/96	Lancaster	ug/L	22,800	1,000	U	100	7.2	NR	71	10	U	NR	NR	20
113-W-102-D-230596-849F	05/23/96	Lancaster	ug/L	21,600	1,000	U	100	NR	NR	NR	10	U	24,200	900	9
113-W-102-D-230596-849T	05/23/96	Lancaster	ug/L	20,000	1,000	U	100	7.2	NR	NR	10	U	NR	NR	200
113-W-103-090693-164F	06/09/93	Lancaster	ug/L	228	20	U	2	NR	NR	NR	NR	NR	NR	NR	NR
113-W-103-090693-164T	06/09/93	Lancaster	ug/L	1,510	20	U	2	7.1	NR	278	NR	NR	NR	NR	NR
113-W-103-290596-851F	05/29/96	Lancaster	ug/L	1,730	200	U	20	NR	NR	NR	10	U	NR	NR	9
113-W-103-290596-851T	05/29/96	Lancaster	ug/L	2,640	200	U	20	7.0	NR	204	10	U	NR	NR	240
113-W-103-050696-855F	06/05/96	Lancaster	ug/L	3,210	200	U	20	NR	NR	NR	10	U	NR	NR	9
113-W-103-050696-855T	06/05/96	Lancaster	ug/L	2,540	200	U	20	7.3	NR	150	10	U	NR	NR	9
113-W-103-220796-865F	07/22/96	Lancaster	ug/L	1,550	100	U	10	NR	NR	NR	NR	NR	NR	NR	9
113-W-103-220796-865T	07/22/96	Lancaster	ug/L	1,730	100	U	10	7.0	NR	200	NR	NR	NR	NR	300
113-W-103-D-090693-164T	06/09/93	Lancaster	ug/L	1,640	20	U	2	7.1	NR	NR	NR	NR	NR	NR	NR
113-W-104-070693-162F	06/07/93	Lancaster	ug/L	3.1	10	U	1	NR	NR	NR	NR	NR	NR	NR	NR
113-W-104-070693-162T	06/07/93	Lancaster	ug/L	499	10	U	1	6.7	NR	89	NR	NR	NR	NR	NR
113-W-104-280596-851F	05/28/96	Lancaster	ug/L	2,970	3,000		4	NR	NR	NR	NR	5,100	1000	57	
113-W-104-280596-851T	05/28/96	Lancaster	ug/L	2,810	2,270		4	13	NR	201	NR	NR	NR	310	
113-W-104-D-280596-851F	05/28/96	Lancaster	ug/L	2,770	3,550		4	NR	NR	NR	NR	NR	NR	9	
113-W-104-D-280596-851T	05/28/96	Lancaster	ug/L	2,900	2,560		4	13	NR	NR	NR	NR	NR	80	
113-W-105-090693-164F	06/09/93	Lancaster	ug/L	44.1	10	U	1	NR	NR	NR	NR	NR	NR	NR	NR
113-W-105-090693-164T	06/09/93	Lancaster	ug/L	245	10	U	1	6.2	NR	147	NR	NR	NR	NR	NR
113-W-105-030696-853F	06/03/96	Lancaster	ug/L	40.1	10	U	1	NR	NR	NR	NR	NR	NR	NR	85
113-W-105-030696-853T	06/03/96	Lancaster	ug/L	54.2	10	U	1	6.0	NR	197	NR	NR	94	NR	NR
113-W-105-D-090693-164F	06/09/93	Lancaster	ug/L	41.2	10	U	1	NR	NR	NR	NR	NR	NR	NR	NR
113-W-105-D-030696-853F	06/03/96	Lancaster	ug/L	43.2	10	U	1	NR	NR	NR	NR	NR	NR	NR	72
113-W-105-D-030696-853T	06/03/96	Lancaster	ug/L	57	10	U	1	6.0	NR	NR	NR	NR	NR	NR	84
113-W-106-080693-162F	06/08/93	Lancaster	ug/L	118	10	U	1	NR	NR	NR	NR	NR	NR	NR	NR
113-W-106-080693-162T	06/08/93	Lancaster	ug/L	195	10	U	1	5.2	NR	337	NR	NR	NR	NR	NR
113-W-106-040696-855F	06/04/96	Lancaster	ug/L	59.6	10	U	1	NR	NR	NR	NR	NR	NR	NR	70
113-W-106-040696-855T	06/04/96	Lancaster	ug/L	192	50	U	5	6.9	NR	36	100,000	U	NR	NR	120
113-W-106-D-080693-162F	06/08/93	Lancaster	ug/L	111	10	U	1	NR	NR	NR	NR	NR	NR	NR	NR
113-W-106-D-080693-162T	06/08/93	Lancaster	ug/L	209	10	U	1	5.2	NR	NR	NR	NR	NR	NR	NR
113-W-107-070693-162F	06/07/93	Lancaster	ug/L	4,820	2,100		5	NR	NR	NR	NR	NR	NR	NR	NR

**TABLE 113-04**  
**SUMMARY OF GROUNDWATER AND SURFACE WATER CHARACTERIZATION**  
**TOTAL Cr, Cr (VI), pH, ORP AND PERCENT SOLIDS**  
**SITE 113 - DIAMOND SITE**

Sample ID	Date Collected	Laboratory	Units (A)	Total Cr	Cr(VI)	Cr(VI) Dilution Factor	pH (s.n.)	Percent Solids	ORP mV (Eh)	Cr(VI) by IC	Total Dissolved Solids (mg/L)	Chlorides (mg/L)	Total Suspended Solids (mg/L)	
113-W-107-070693-162T	06/07/93	Lancaster	ug/L	5,490	2,100	5	6.7	NR	289	NR	NR	NR	NR	
113-W-107-300596-851F	05/30/96	Lancaster	ug/L	645	10	U	1	NR	NR	NR	NR	NR	9	U
113-W-107-300596-851T	05/30/96	Lancaster	ug/L	888	10	U	1	6.5	NR	172	NR	NR	50	
113-W-108-100693-165F	06/10/93	Lancaster	ug/L	122	10	U	1	NR	NR	NR	NR	NR	NR	
113-W-108-100693-165T	06/10/93	Lancaster	ug/L	377	10	U	1	6.6	NR	103	NR	NR	NR	
113-W-108-040696-853F	06/04/96	Lancaster	ug/L	264	10	U	1	NR	NR	NR	NR	NR	360	
113-W-108-040696-853T	06/04/96	Lancaster	ug/L	681	10	U	1	7.3	NR	223	NR	NR	1060	
113-W-108-D-100693-165F	06/10/93	Lancaster	ug/L	141	10	U	1	NR	NR	NR	NR	NR	NR	
113-W-108-D-100693-165T	06/10/93	Lancaster	ug/L	377	10	U	1	6.6	NR	NR	NR	NR	NR	
113-W-109-080693-164F	06/08/93	Lancaster	ug/L	81.2	10	U	1	NR	NR	NR	NR	NR	NR	
113-W-109-080693-164T	06/08/93	Lancaster	ug/L	484	10	U	1	6.7	NR	125	NR	NR	NR	
113-W-109-050696-855F	06/05/96	Lancaster	ug/L	28.3	10	U	1	NR	NR	NR	NR	NR	46	
113-W-109-050696-855T	06/05/96	Lancaster	ug/L	49.6	10	U	1	6.7	NR	203	NR	NR	51	
113-W-109-D-050696-855F	06/05/96	Lancaster	ug/L	33.2	10	U	1	NR	NR	NR	NR	NR	40	
113-W-109-D-050696-855T	06/05/96	Lancaster	ug/L	54.6	10	U	1	6.5	NR	NR	NR	NR	56	
113-W-113-070693-162F	06/07/93	Lancaster	ug/L	8,330	9,000	10	NR	NR	NR	NR	NR	NR	NR	
113-W-113-070693-162T	06/07/93	Lancaster	ug/L	19,900	8,900	10	13	NR	61	NR	NR	NR	NR	
113-W-113-040696-853F	06/04/96	Lancaster	ug/L	7,600	8,600	25	NR	NR	NR	NR	NR	NR	9	U
113-W-113-040696-853T	06/04/96	Lancaster	ug/L	8,260	7,300	25	13	NR	274	NR	NR	NR	45	
113-W-114-100693-165F	06/10/93	Lancaster	ug/L	54,900	57,700	100	NR	NR	NR	NR	NR	NR	NR	
113-W-114-100693-165T	06/10/93	Lancaster	ug/L	91,900	56,700	100	13	NR	-10	NR	NR	NR	NR	
113-W-114-030696-853F	06/03/96	Lancaster	ug/L	45,100	52,000	100	NR	NR	NR	NR	NR	NR	9	U
113-W-114-030696-853T	06/03/96	Lancaster	ug/L	49,300	52,000	100	13	NR	65	NR	NR	NR	18	
113-W-115-090693-164T	06/09/93	Lancaster	ug/L	47,700	24,300	50	12	NR	87	NR	NR	NR	NR	
113-W-115-100693-164F	06/10/93	Lancaster	ug/L	22,100	24,200	50	NR	NR	NR	NR	NR	NR	NR	
113-W-115-290596-851F	05/29/96	Lancaster	ug/L	18,600	17,600	25	NR	NR	NR	NR	NR	NR	9	U
113-W-115-290596-851T	05/29/96	Lancaster	ug/L	17,600	17,600	25	12	NR	139	NR	NR	NR	50	
113-W-116-070693-162F	06/07/93	Lancaster	ug/L	4,240	6,000	10	NR	NR	NR	NR	NR	NR	NR	
113-W-116-070693-162T	06/07/93	Lancaster	ug/L	5,880	6,400	10	13	NR	-51	NR	NR	NR	NR	
113-W-116-290596-851F	05/29/96	Lancaster	ug/L	2.8	10	U	1	NR	NR	NR	NR	NR	98	
113-W-116-290596-851T	05/29/96	Lancaster	ug/L	41.2	10	U	1	6.6	NR	123	NR	NR	440	
113-W-117-090693-164F	06/09/93	Lancaster	ug/L	5,830	5,400	10	NR	NR	NR	NR	NR	NR	NR	
113-W-117-090693-164T	06/09/93	Lancaster	ug/L	7,120	4,900	10	12	NR	108	NR	NR	NR	NR	
113-W-117-030696-853F	06/03/96	Lancaster	ug/L	24,700	14,000	25	NR	NR	NR	NR	NR	NR	20	
113-W-117-030696-853T	06/03/96	Lancaster	ug/L	35,600	9,500	10	12	NR	206	NR	NR	NR	613	
113-W-118-080693-162F	06/08/93	Lancaster	ug/L	46,900	56,000	100	NR	NR	NR	NR	NR	NR	NR	
113-W-118-080693-162T	06/08/93	Lancaster	ug/L	71,800	55,700	50	13	NR	137	NR	NR	NR	NR	
113-W-118-040696-855F	06/04/96	Lancaster	ug/L	77,900	86,000	100	NR	NR	NR	NR	NR	NR	9	U
113-W-118-040696-855T	06/04/96	Lancaster	ug/L	77,900	77,000	100	13	NR	180	NR	NR	NR	9	U

**TABLE 113-04**  
**SUMMARY OF GROUNDWATER AND SURFACE WATER CHARACTERIZATION**  
**TOTAL Cr, Cr (VI), pH, ORP AND PERCENT SOLIDS**  
**SITE 113 - DIAMOND SITE**

Sample ID	Date Collected	Laboratory	Units (A)	Total Cr	Cr(VI)	Cr(VI) Dilution Factor	pH (s.u.)	Percent Solids	ORP mV (Eh)	Cr(VI) by IC	Total Dissolved Solids (mg/L)	Chlorides (mg/L)	Total Suspended Solids (mg/L)
113-W-119-090693-164F	06/09/93	Lancaster	ug/L	99.1	10	U	1	NR	NR	NR	NR	NR	NR
113-W-119-090693-164T	06/09/93	Lancaster	ug/L	2,020	10	U	1	8.6	NR	72	NR	NR	NR
113-W-119-300596-851F	05/30/96	Lancaster	ug/L	89.3	10	U	1	NR	NR	NR	NR	NR	9 U
113-W-119-300596-851T	05/30/96	Lancaster	ug/L	380	10	U	1	7.5	NR	21	NR	NR	9 U
113-W-120-100693-165F	06/10/93	Lancaster	ug/L	149	10	U	1	NR	NR	NR	NR	NR	NR
113-W-120-100693-165T	06/10/93	Lancaster	ug/L	3,980	10	U	1	7.3	NR	119	NR	NR	NR
113-W-120-040696-853F	06/04/96	Lancaster	ug/L	97.3	10	U	1	NR	NR	NR	NR	NR	9 U
113-W-120-040696-853T	06/04/96	Lancaster	ug/L	260	10	U	1	7.4	NR	444	NR	NR	36
113-W-121-080693-164F	06/08/93	Lancaster	ug/L	65.3	10	U	1	NR	NR	NR	NR	NR	NR
113-W-121-080693-164T	06/08/93	Lancaster	ug/L	17,400	10	U	1	11	NR	37	NR	NR	NR
113-W-121-050696-855F	06/05/96	Lancaster	ug/L	2.8	U	10	U	1	NR	NR	NR	NR	9 U
113-W-121-050696-855T	06/05/96	Lancaster	ug/L	66	10	U	1	10	NR	200	NR	NR	59
113-S-125A-240992-068F	09/24/92	Accutest	ug/L	9	18		1	NR	NR	NR	NR	NR	NR
113-S-125A-240992-068F RMA	09/24/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-125A-240992-068T	09/24/92	Accutest	ug/L	63	17		1	7.3	NR	NR	NR	NR	NR
113-S-125A-240992-068T RMA	09/24/92	Enseco-RMA	ug/L	139	NR	NR	NR	NR	NR	NR	NR	NR	NR
113-S-125D-240992-068F	09/24/92	Accutest	ug/L	3	U	10	U	1	NR	NR	NR	NR	NR
113-S-125B-240992-068F RMA	09/24/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-125B-240992-068T	09/24/92	Accutest	ug/L	6	27		1	7.7	NR	NR	NR	NR	NR
113-S-125D-240992-068T RMA	09/24/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-125C-240992-068F	09/24/92	Accutest	ug/L	5	10		1	NR	NR	NR	NR	NR	NR
113-S-125C-240992-068F RMA	09/24/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-125C-240992-068T	09/24/92	Accutest	ug/L	10	24		1	7.7	NR	NR	NR	NR	NR
113-S-125C-240992-068T RMA	09/24/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-126A-230992-068F	09/23/92	Accutest	ug/L	4	10	U	1	NR	NR	NR	NR	NR	NR
113-S-126A-230992-068F RMA	09/23/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-126A-230992-068T	09/23/92	Accutest	ug/L	23	10	U	1	7.6	NR	NR	NR	NR	NR
113-S-126A-230992-068T RMA	09/23/92	Enseco-RMA	ug/L	83.4	NR	NR	NR	NR	NR	NR	NR	NR	NR
113-S-126A-D-230992-068F	09/23/92	Accutest	ug/L	3	U	10	U	1	NR	NR	NR	NR	NR
113-S-126A-D-230992-068F RMA	09/23/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-126A-D-230992-068T	09/23/92	Accutest	ug/L	18	10	U	1	6.8	NR	NR	NR	NR	NR
113-S-126A-D-230992-068T RMA	09/23/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-126B-230992-068F	09/23/92	Accutest	ug/L	2	U	10	U	1	NR	NR	NR	NR	NR
113-S-126B-230992-068F RMA	09/23/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-126B-230992-068T	09/23/92	Accutest	ug/L	5	10	U	1	7.3	NR	NR	NR	NR	NR
113-S-126B-230992-068T RMA	09/23/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-126C-230992-068F	09/23/92	Accutest	ug/L	3	U	10	U	1	NR	NR	NR	NR	NR
113-S-126C-230992-068F RMA	09/23/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-126C-230992-068T	09/23/92	Accutest	ug/L	9	10	U	1	7.8	NR	NR	NR	NR	NR

**TABLE 113-04**  
**SUMMARY OF GROUNDWATER AND SURFACE WATER CHARACTERIZATION**  
**TOTAL Cr, Cr (VI), pH, ORP AND PERCENT SOLIDS**  
**SITE 113 - DIAMOND SITE**

Sample ID	Date Collected	Laboratory	Units (A)	Total Cr	Cr(VI)	Dilution Factor	pH (s.u.)	Percent Solids	ORP mV (Eh)	Cr(VI) by IC	Total Dissolved Solids (mg/L)	Chlorides (mg/L)	Total Suspended Solids (mg/L)
113-S-126C-230992-06HT RMA	09/23/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-122A-151092-085F	10/15/92	Accutest	ug/L	NR	10	U	1	NR	NR	NR	NR	NR	NR
113-S-122A-151092-085F	10/15/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-122A-151092-085T	10/15/92	Accutest	ug/L	NR	10	U	1	7.5	NR	NR	NR	NR	NR
113-S-122A-151092-085T	10/15/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-122A-D-151092-085F	10/15/92	Accutest	ug/L	NR	10	U	1	NR	NR	NR	NR	NR	NR
113-S-122A-D-151092-085F	10/15/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-122A-D-151092-085T	10/15/92	Accutest	ug/L	NR	10	U	1	7.5	NR	NR	NR	NR	NR
113-S-122A-D-151092-085T	10/15/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-122B-151092-085F	10/15/92	Accutest	ug/L	NR	10	U	1	NR	NR	NR	NR	NR	NR
113-S-122B-151092-085F	10/15/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-122B-151092-085T	10/15/92	Accutest	ug/L	NR	10	U	1	7.5	NR	NR	NR	NR	NR
113-S-122B-151092-085T	10/15/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-122C-151092-085F	10/15/92	Accutest	ug/L	NR	10	U	1	NR	NR	NR	NR	NR	NR
113-S-122C-151092-085F	10/15/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-122C-151092-085T	10/15/92	Accutest	ug/L	NR	10	U	1	7.5	NR	NR	NR	NR	NR
113-S-122C-151092-085T	10/15/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-123A-081092-081F	10/08/92	Accutest	ug/L	NR	10	U	1	NR	NR	NR	NR	NR	NR
113-S-123A-081092-081F	10/08/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-123A-081092-081T	10/08/92	Accutest	ug/L	NR	104		1	7.7	NR	NR	NR	NR	NR
113-S-123A-081092-081T	10/08/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-123A-D-081092-081F	10/08/92	Accutest	ug/L	NR	10	U	1	NR	NR	NR	NR	NR	NR
113-S-123A-D-081092-081F	10/08/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-123A-D-081092-081T	10/08/92	Accutest	ug/L	NR	35.2		1	7.7	NR	NR	NR	NR	NR
113-S-123A-D-081092-081T	10/08/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-123B-081092-081F	10/08/92	Accutest	ug/L	NR	10	U	1	NR	NR	NR	NR	NR	NR
113-S-123B-081092-081F	10/08/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-123B-081092-081T	10/08/92	Accutest	ug/L	NR	10	U	1	7.6	NR	NR	NR	NR	NR
113-S-123B-081092-081T	10/08/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-123C-081092-081F	10/08/92	Accutest	ug/L	NR	10	U	1	NR	NR	NR	NR	NR	NR
113-S-123C-081092-081F	10/08/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-123C-081092-081T	10/08/92	Accutest	ug/L	NR	10	U	1	7.7	NR	NR	NR	NR	NR
113-S-123C-081092-081T	10/08/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-124A-011092-074F	10/01/92	Accutest	ug/L	NR	10	U	1	NR	NR	NR	NR	NR	NR
113-S-124A-011092-074F	10/01/92	Enseco-RMA	ug/L	80		NR	NR	NR	NR	NR	NR	NR	NR
113-S-124A-011092-074T	10/01/92	Accutest	ug/L	NR	13.4		1	7.6	NR	NR	NR	NR	NR
113-S-124A-011092-074T	10/01/92	Enseco-RMA	ug/L	40	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-124B-011092-074F	10/01/92	Accutest	ug/L	NR	10	U	1	NR	NR	NR	NR	NR	NR
113-S-124B-011092-074F	10/01/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR



**TABLE 113-04**  
**SUMMARY OF GROUNDWATER AND SURFACE WATER CHARACTERIZATION**  
**TOTAL Cr, Cr (VI), pH, ORP AND PERCENT SOLIDS**  
**SITE 113 - DIAMOND SITE**

Sample ID	Date Collected	Laboratory	Units (A)	Total Cr	Cr(VI)	Cr(VI) Dilution Factor	pH (s.u.)	Percent Solids	ORP mV (Eh)	Cr(VI) by IC	Total Dissolved Solids (mg/L)	Chlorides (ug/L)	Total Suspended Solids (mg/L)
113-S-124B-011092-074T	10/01/92	Accutest	ug/L	NR	10	U	1	7.6	NR	NR	NR	NR	NR
113-S-124B-011092-074T	10/01/92	Enseco-RMA	ug/L	40	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-124B-D-011092-074F	10/01/92	Accutest	ug/L	NR	10	U	1	NR	NR	NR	NR	NR	NR
113-S-124B-D-011092-074F	10/01/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-124B-D-011092-074T	10/01/92	Accutest	ug/L	NR	10	U	1	7.6	NR	NR	NR	NR	NR
113-S-124B-D-011092-074T	10/01/92	Enseco-RMA	ug/L	40	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-124C-011092-074F	10/01/92	Accutest	ug/L	NR	10	U	1	NR	NR	NR	NR	NR	NR
113-S-124C-011092-074F	10/01/92	Enseco-RMA	ug/L	80	U	NR	NR	NR	NR	NR	NR	NR	NR
113-S-124C-011092-074T	10/01/92	Accutest	ug/L	NR	10	U	1	7.6	NR	NR	NR	NR	NR
113-S-124C-011092-074T	10/01/92	Enseco-RMA	ug/L	40	U	NR	NR	NR	NR	NR	NR	NR	NR

**Notes:**

(A) - Unless otherwise specified

D - Field Duplicate

F - Filtered (dissolved)

T - Unfiltered (total)

W - Groundwater

S - Surface Water

NR - Not Requested

U - The material was analyzed for this parameter, but was not detected at or above the associated numerical value.

Eh - Field ORP measurement has been converted to Eh based on the reference electrode used.

mV - Millivolts

- ☐ - Concentration exceeds Site Specific ARS concentration for Cr (960 ug/L); NJGWQS for TDS (500 mg/L); NJGWQS for Chlorides (250 mg/L)
- ☐ - Concentration exceeds NJSWQS of 3,230 ug/L.

A,B,C - Designates relatively increasing distance of surface water samples from shoreline samples from shoreline